

A Guide to the Jellyfish

of the
Canadian Atlantic Waters

C. T. Shin



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Cyanea capillata

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of Canadian Atlantic Waters**

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of Canadian Atlantic Waters**

C.T. Shih

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Biographical Note

Born in Amoy, China, Chang-tai Shih graduated from National Taiwan University with a B.Sc. in zoology in 1958 and from McGill University with a Ph.D. in biological oceanography in 1966. Dr. Shih was an assistant professor at Lakehead University in Thunder Bay, Ontario, before he joined the Canadian Aquatic Identification Centre of the National Museum of Natural Sciences in 1967. His main interests are in the systematical and ecological studies of marine invertebrates, with emphasis on planktonic forms. He has published several scientific papers on the systematics and biology of amphipods, isopods, and copepods and is the co-author of *A Synopsis of Canadian Marine Zooplankton*. His professional memberships include the Canadian Society of Zoologists, the American Society of Limnology and Oceanography, and the Ecological Society of America.

Summary

This guide provides reasonably reliable, comprehensive, and well-illustrated information concerning the jellyfish of Canadian Atlantic coastal waters.

A brief introduction to the morphology and biology of the Cnidaria, methodology of collecting and preserving jellyfish, and the importance of jellyfish to man are followed by identification keys, diagnoses, and illustrations of 56 species of jellyfish in 44 genera, 27 families, seven orders, and two classes known to occur within the region. Pronunciation and meaning of all scientific names are given at the appropriate place to make the reader acquainted with these animals.

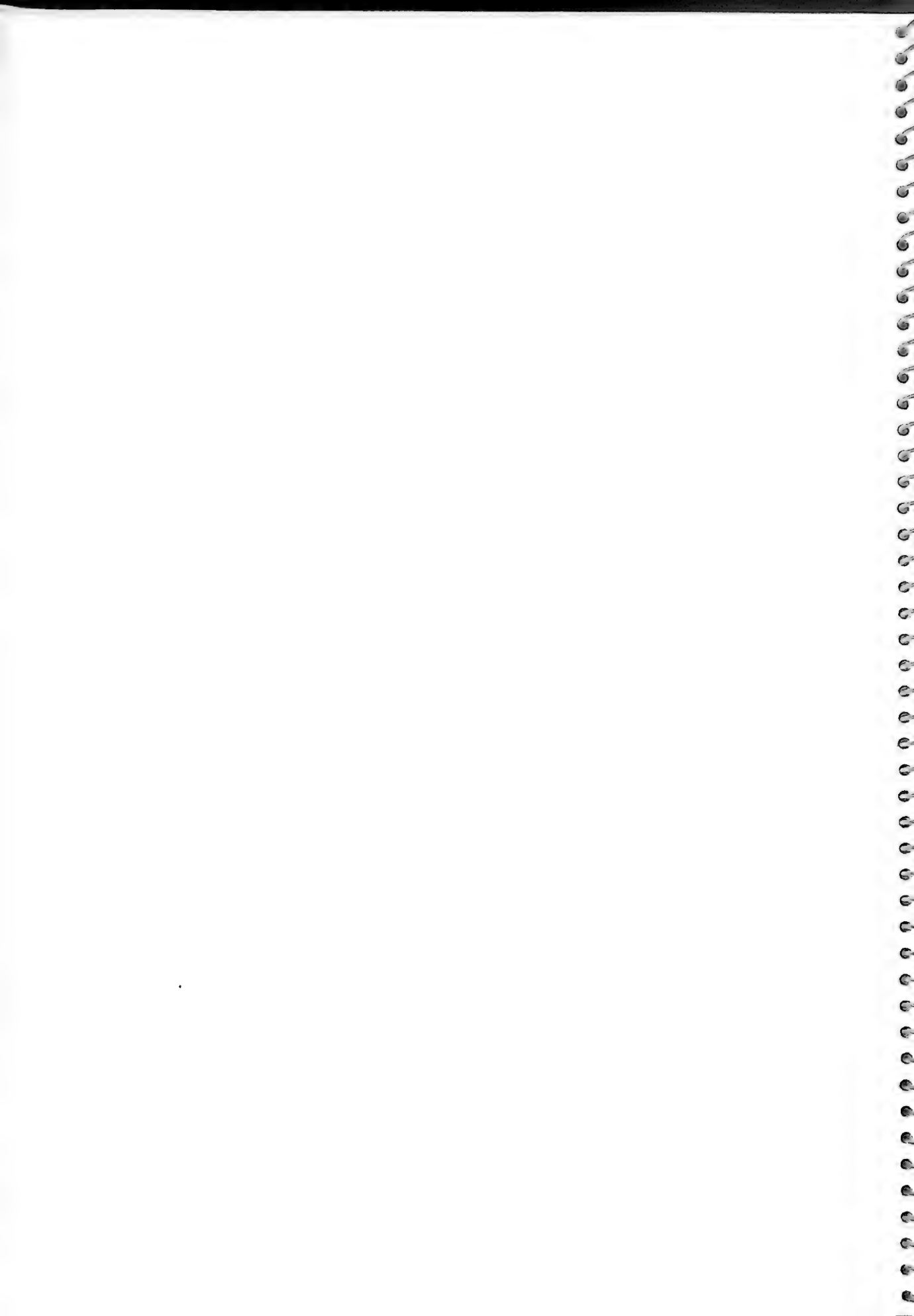
A distribution table of species within the region is given. A list of selected references is attached for readers who wish to pursue further information concerning taxonomy and biology of the jellyfish. A glossary of scientific terms used in the diagnoses, and keys and an index to scientific names are included.

Résumé

Ce guide donne des renseignements suffisamment fiables, détaillés et bien illustrés ayant trait aux méduses des eaux des côtes canadiennes de l'Atlantique.

Une courte introduction à la morphologie et à la biologie des Cnidaires précède une description des méthodes de cueillette et de conservation des méduses et une explication de leur importance pour l'homme. Des clés d'identification, des diagnoses et des illustrations permettent d'identifier et de classer 56 espèces réparties en 44 genres, 27 familles, sept ordres et deux classes dont on connaît la présence dans la région.

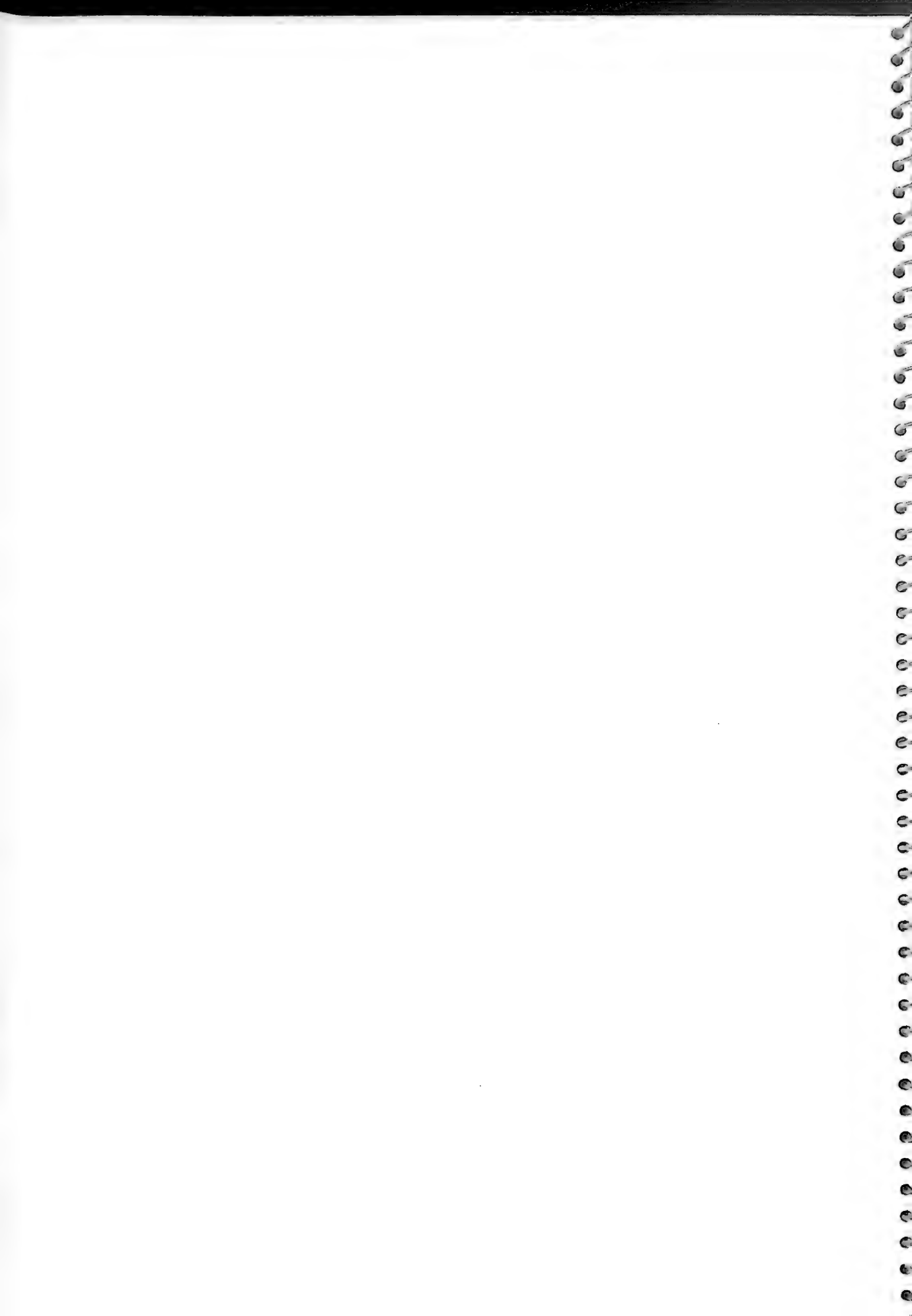
Le profane pourra se familiariser avec ces animaux grâce à la prononciation et à la signification des noms scientifiques qu'il trouvera aux endroits appropriés. Les lecteurs désirant approfondir l'étude de la taxonomie et de la biologie des méduses pourront le faire en consultant les références dont ils auront la liste à la fin du volume, à la suite d'un tableau de distribution des espèces. Ils trouveront, au même endroit, un glossaire des termes scientifiques utilisés dans les diagnoses et dans les clés, ainsi qu'un index des noms scientifiques.



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I would like to thank Drs. M.N. Arai (University of Calgary), A. Brinckmann-Voss (Royal Ontario Museum), D.R. Calder (formerly of the Virginia Institute of Marine Science), C.C. Davis (Memorial University of Newfoundland), D.S. Davis (Nova Scotia Museum), M.J. Dunbar (McGill University), C. Edwards (Scottish Marine Biological Association), B. Griffith (CSIRO Division of Fisheries and Oceanography, Australia), and G.O. Mackie (University of Victoria) for many constructive comments on taxonomy of Cnidaria and other related matters. Dr. Edwards is also acknowledged for supplying me with additional information on preservation, and for calling my attention to some pertinent publications.

I am grateful to Dr. D.J. Faber of the Canadian Aquatic Identification Centre, National Museum of Natural Sciences. Without his continual encouragement and support, this publication would never have been completed. Sally Gadd of Ottawa prepared all the illustrations; her detailed drawings have contributed significantly to the usefulness of this book. The colour frontispiece was photographed by Dr. D.R. Calder.



Foreword

Because of the general decline in quality of the natural environment and our dearth of knowledge about the microscopic aquatic life, there is a need for illustrated faunal and floral guides. The staff of the Canadian Aquatic Identification Centre (C.A.I.C.) have been stimulated to develop such guides by the examination and identification of large numbers of preserved animals. These guides would not substitute for a purely technical study of their systematics and zoogeography, but rather they would serve to bridge the gap between technical and educational publications.

The National Museum of Natural Sciences plans to publish miscellaneous laboratory identification guides that serve several purposes: to describe and document clearly the various forms of aquatic life in Canadian waters, to provide a useful guide to their identification, and to disseminate information about their complex lives. Many of the animals we will be examining are microscopic in size, and since good illustrations of microscopic aquatic animals are non-existent, or are widely scattered in the published literature, these guides will bring all the known forms together and portray them in a uniform style of illustration.

This guide to the jellyfish of Canadian Atlantic waters, written by Dr. C.T. Shih, is the first to be published by the C.A.I.C., but others are in preparation. This issue describes, with white on black illustrations, the 56 jellyfish species that have previously been reported in Canadian Atlantic coastal waters.

Daniel J. Faber
Canadian Aquatic Identification Centre



Figure 1
Map of Canadian Atlantic waters from coast, seaward to 200-m contour line.

Introduction

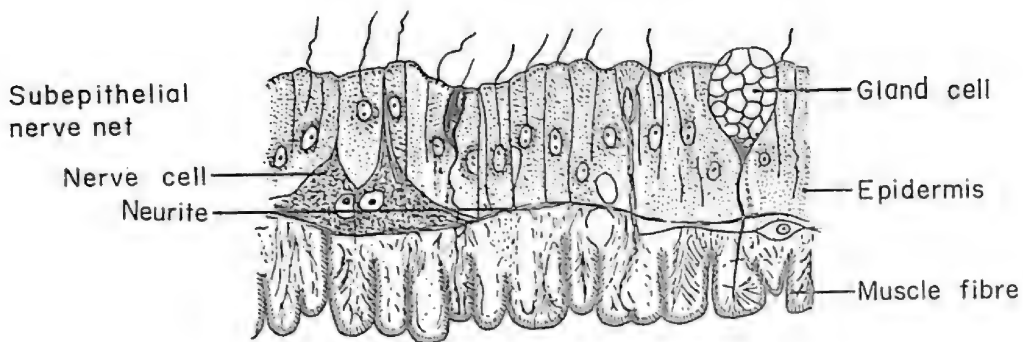
This identification guide covers the Canadian Atlantic coastal waters south of Hudson Strait, from the coast seaward to the 200-metre contour line, and including the whole of the Gulf of St. Lawrence and the Bay of Fundy (Figure 1). It deals with the jellyfish, a group in the zooplankton (animals drifting and floating in the water) belonging to the phylum Cnidaria.

The Cnidaria include such animals as hydroids (polyps), jellyfish (medusae), sea anemones, and corals. They are typically characterized by radial symmetry along an oral-aboral axis and by tentacles around the oral body opening. In medusae, tentacles are also present as a fringe around the margin. The name Cnidaria (Gk. *cnidos*: nettle) originated from the threadlike intracellular structure of the stinging cells.

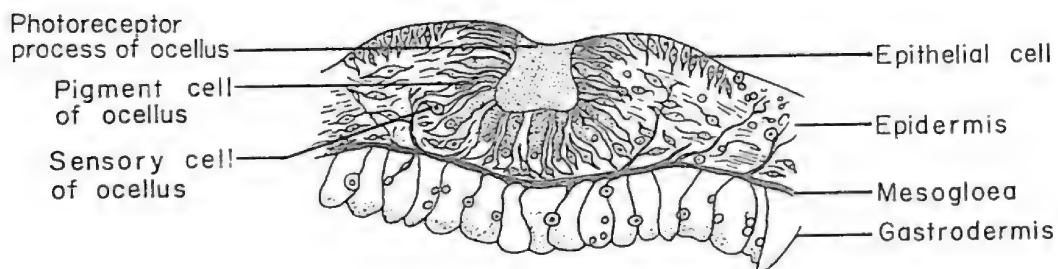
The body structure of these animals (Figure 2) is simple, although some sensory organs such as ocelli and statocysts are present. The body wall is made up of three layers, the outer epidermis, intermediate mesogloea and inner gastrodermis. The epidermis and gastrodermis are both composed of cuboidal and columnar epithelial cells interspersed with glandular, sensory and nerve cells. The mesogloea is composed chiefly of gelatinous material but amoebocytes or wandering cells and muscle cells may be present in some groups. The nematocysts or "stinging cells" characteristic of this phylum are not cells but structures formed within specialized cells (nematocytes). Nematocytes are derived from undifferentiated cells and are found in both epidermis and gastrodermis but are concentrated in the tentacles, in gastrodermis tentacle-like structures, and in the general oral region. Different types of nematocysts have different functions, namely catching prey, defence, and attachment during locomotion. The stomach or gastrovascular cavity connects with the external medium through the mouth or oral opening, which serves for ingestion of food and egestion of wastes. Digestion may occur extracellularly in the stomach or intracellularly in the gastrodermis. Muscular and nervous systems are present in these animals. Muscle fibres are formed by the transformation of the bases of epithelial cells, and in polyps they are arranged along the body axis in the epidermis and circumferentially in the gastrodermis. In polyps, longitudinal fibres contract the body while circular fibres extend it. In medusae, circular and radial fibres are found in the epidermis. The nervous system is formed by sensory cells and a subepithelial nerve net, or plexus, composed of bipolar and multipolar nerve cells. Sensory cells in the gastrodermis and epidermis are connected by neurites (processes from sensory cells) to the nerve net, elements of which also innervate the muscle cells. The nerve net is more developed in the epidermis than in the gastrodermis. In *Hydra* it is especially concentrated around the oral region. In medusae the major nerve centres, or ganglia, are located at the umbrella margin. There are no special structures for respiration. Gaseous exchange apparently takes place in the epidermal cells of the body wall and tentacles, and through the gastrodermis in species that circulate sea water through the interior (e.g., *Aurelia*). In a few medusae, openings of the radial canal near the tentacles probably serve an excretory function. Most corals and many other forms have intracellular symbiotic algae, with which metabolites are exchanged.

Many cnidarians show an alternation between two morphological forms, polyp and medusa, during their life cycle (Figure 3), although in some groups only one of these forms exists. Where both forms exist, the polyps represent the asexual phase, whereas the medusae represent the sexual phase. The fertilized egg develops into a planula, or a free-swimming larva, which settles on a firm substrate and metamorphoses into a polyp. The polymorphic nature of cnidarians is further demonstrated by some forms in which the polyp stage is colonial, each colony being composed of a number of morphologically distinct individuals, each of which performs a specific set of functions.

Medusae are usually planktonic, whereas polyps usually live attached to the bottom or to some other substrate. Since polyps are caught in plankton nets only



A



B

Figure 2

Sections of medusa showing various types of cells in body wall:

A. Section through the subumbrellar epidermis of *Pelagia* (after Krasinska 1914 from Hyman 1940).

B. Section through the ocellus of *Sarsia* (after Linko 1900 from Hyman 1940).

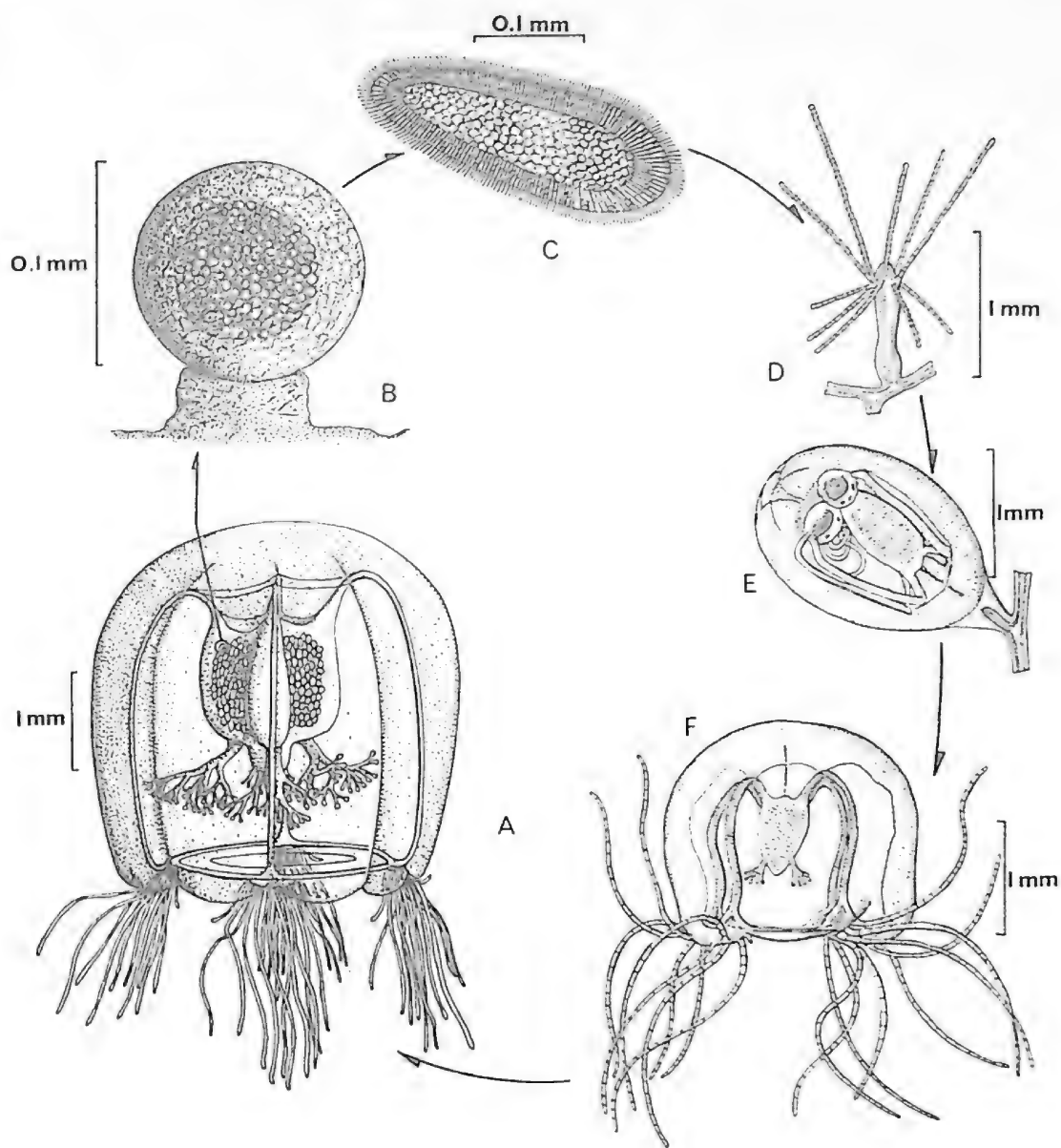


Figure 3
Life cycle of a hydrozoan, *Bougainvillia superciliaris*
(modified from Hyman 1940, Uchida and Nagao
1960, and Werner 1961):
A. Mature medusa
B. Developing embryo
C. Planula
D. Polyp
E. Late medusa bud
F. Young medusa

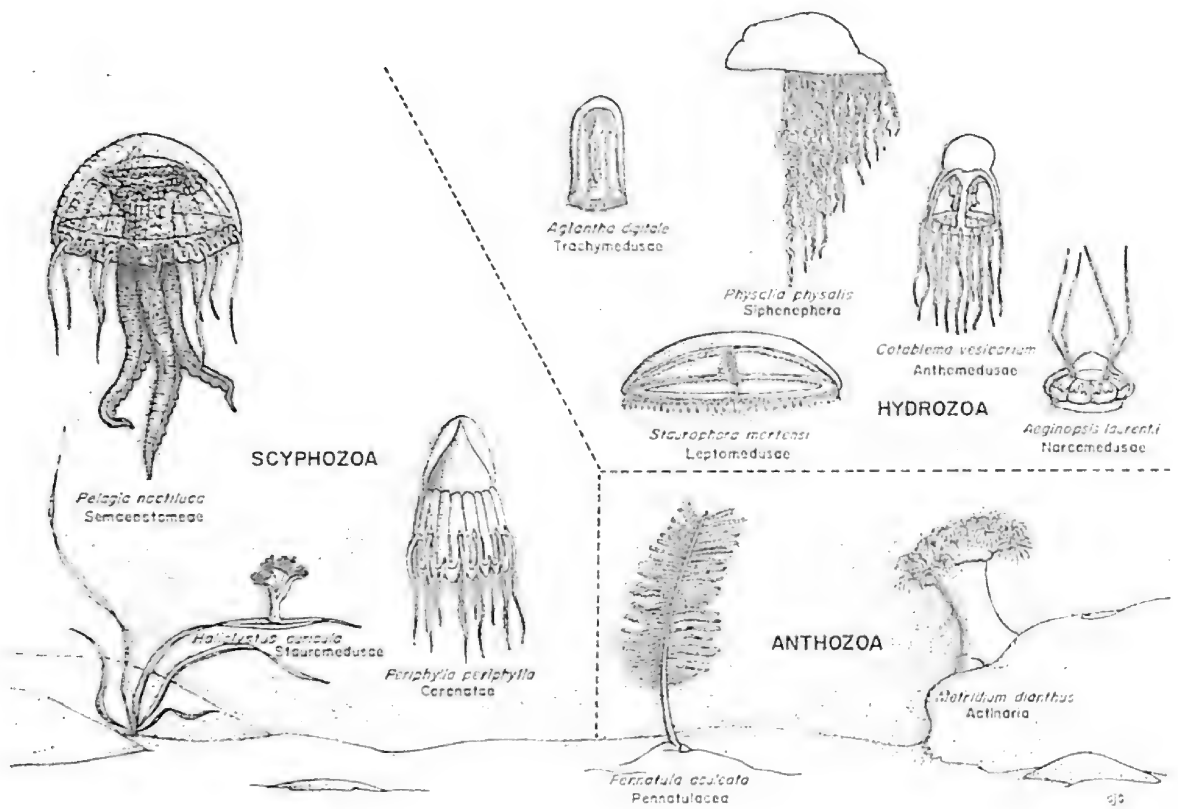


Figure 4
Some examples of cnidarian species belonging to
the classes Hydrozoa, Scyphozoa, and Anthozoa.

Introduction

accidentally and infrequently, this study encompasses the medusa stage only, with the exception of siphonophores, which are planktonic colonial polyps.

There are about 9,000 living species in the phylum Cnidaria; most live in marine water but a small number inhabit fresh water. Most systematists recognize three classes within the Cnidaria: the Hydrozoa, the Scyphozoa and the Anthozoa (Figure 4). The Anthozoa, comprising many colourful animals such as sea anemones and corals, live attached to the sea bottom and possess no medusae, and for this reason will be excluded from further discussion. In the Canadian Atlantic coastal waters, 56 species of medusae and siphonophores have been reported, representing 44 genera, 27 families, seven orders and two classes. The distribution of these species is summarized on page 81.

The diagnoses and sizes of the planktonic cnidarians of the Canadian Atlantic given below are based entirely on *Synopsis of the Medusae of the World* by Kramp (1961), *Medusae of the British Isles* (2 vols.) by Russell (1953, 1970), and a *Synopsis of the Siphonophora* by Totton (1965), although minor modifications have been made to keep the descriptions consistent throughout the text. Information on the occurrence of these animals within the region has been compiled by Shih (1971).

There is one illustration for each species. Most of these illustrations were drawn, somewhat diagrammatically, from preserved specimens available in National Museums collections. The remainder were redrawn entirely or modified from the literature. The illustrations, except those of the Siphonophora, are shown in three tones of grey to indicate different structures: light for canal system, medium for jelly portion of the umbrella, and dark for gonads. These tones also reflect the relative opaqueness of the various parts of the jellyfish when viewed under a microscope. The height of the jellyfish is the shortest vertical distance between the tip and the margin of the umbrella. The width of the jellyfish is the diameter of the umbrella.

The scientific names of animals are usually derived from Latin and Greek roots, and are often difficult to understand and pronounce by the layman. In animal classification, the ending for a family name is *-idae*; the endings for orders and classes are not consistent. To assist the reader in becoming familiar with the scientific names, a simplified pronunciation guide and the meaning of the root word are provided, although there is no single, absolutely correct way of pronouncing these names. For simplicity, only two pronunciation symbols are used, indicating long and short vowels, as *ā* in *ate* and *ă* in *at*. A vowel without any symbol is to be pronounced according to common pronunciation for that vowel in the given context, as for example, *a* in *are*, *ago*, or *air*. The stressed syllable is printed in bold, and a hyphen between syllables shows syllabic division.

Importance to Man

All jellyfish are poisonous to some degree, but fortunately the toxic effects of most jellyfish are not perceptible to man. According to Halstead (1965), there are only about 20 species that have been associated with injuries to man or are known to be capable of penetrating the human skin. Most of these venomous jellyfish live in tropical and temperate waters. In the Canadian Atlantic waters five of the 56 species reported here are toxic to man, namely *Sarsia tubulosa*, *Physalia physalis* (Portuguese man-of-war), *Pelagia noctiluca* (mauve stinger), *Cyanea capillata* (lion's mane), and *Aurelia aurita* (moon jelly). Stings from *Sarsia tubulosa*, *Pelagia noctiluca*, and *Aurelia aurita* are usually mild and restricted to local skin irritation. *Cyanea capillata* may cause more severe skin lesions and other symptoms, including muscular cramps, coughing, respiratory distress, and a sensation of chest constriction. Stings from *Physalia physalis* may have very severe effects on the victim. The symptoms may include linear and scattered welts, local pain corresponding to the distribution of the axillary lymph nodes, joint and muscle pain, headache, hysteria, chills and fever, muscular cramps, nausea, and vomiting. *Sarsia tubulosa*, *Cyanea capillata*, and *Aurelia aurita* are common species in Canadian waters. *Physalia physalis* and *Pelagia noctiluca* are warm-water species and their sporadic occurrence in our waters is due to the influence of the Gulf Stream.

When treating jellyfish stings, one should first remove the tentacles adhering to the victim's skin by rubbing with sand, clothing, a towel, or any other available material. Alcohol should be applied to the injured area to stop the activity of any remaining adherent nematocysts. Sugar, soap, vinegar, lemon juice, and ammonia and boric acid solutions are reported to be effective for treating skin lesions. Administration of codeine is required to relieve severe pain, and artificial respiration and oxygen should be administered to victims with respiratory distress. Recovery period from stings varies from a few hours to several weeks or longer.

The toxic agents of jellyfish are contained in their nematocysts, and when stimulated, a jellyfish discharges and inflicts its nematocysts, mostly concentrated on the tentacles, upon the victim. Upon discharge, the threadlike tubule of the nematocyst penetrates the tissue of the victim and injects toxic material stored within the nematocyst. The stings may cause mild local skin irritation, or more severe linear or scattered welts or desquamation. In severe cases, death may follow within a few seconds to a couple of hours after contact. The severity of the reaction of the victim depends upon the kind of jellyfish and the number of nematocysts encountered, and upon the length of time that the victim remains in contact with the tentacles.

Jellyfish are carnivores. They feed heavily on zooplankton and their population expands at the expense of the plankton. For instance, *Cyanea* prey on planktonic lobster larvae. A good year of *Cyanea* is usually followed by a poor lobster-fishing season three or four years later. Shoals of *Cyanea*, *Aurelia*, and *Rhizostoma* are detrimental to commercial fishing. They deplete the plankton, the food of the young fish and larger crustaceans, which are in turn eaten by large commercial fish. Some fishermen believe that fish may move away because of the presence of a large jellyfish population. Fishermen also report that their nets are clogged and broken by huge quantities of these large jellyfish.

As a food source for man, jellyfish have been limited to the Pacific cultures. Some jellyfish, when dried and properly processed, are table delicacies to Chinese, Japanese, Koreans, and other peoples of the Pacific. The edible jellyfish belong to the class Scyphozoa, for instance, species of the genera *Rhopilema* and *Tamoya*. In some Canadian cities dried jellyfish may be found at local Oriental food stores. The dried jellyfish should be soaked in water until transparent, sliced, and seasoned with soy sauce, garlic, and sesame oil. The dried jellyfish itself is tasteless, but its crispy and crunchy texture is the most sensational part of this delicacy. Natives of Tawara in the Pacific Ocean are reported to eat freshly caught *Tamoya*. They scrape away the bell and tentacle portions of the body

Importance to Man

with a blunt knife and boil what is left before eating it. The taste of the boiled jellyfish is like that of tripe. If more *Tamoya* are captured than can be consumed immediately, Tawarans dry the excess catch in the sun and store it for future use.

Collection and Preservation

Medusae and siphonophores may be collected with plankton nets, buckets, or dip nets from boats, ranging in size from small row boats to large well-equipped research vessels, proceeding at low speed (2 knots or less); from piers and jetties; from rock pools on the shore; or with plastic bags while diving. These delicate animals are very easily damaged, so that special care in collecting, killing, and preserving is required.

Russell (1953) recommended tying a galvanized bucket or a glass jar to the end of the plankton net, to maintain the plankton in water while the net is being removed from the sea. He also advised the use of a coarse mesh net to reduce the quantity of the sample, if the collector is not particularly interested in smaller organisms. Medusae and siphonophores in such samples are less entangled with each other and more easily sorted than in samples collected with fine mesh nets.

The sample should be poured into a large container of seawater immediately after removal from the sea. The medusae and siphonophores may then be transferred to another container. If observation of live specimens is not desired, concentrated formalin can be squirted by pipette onto the animals while the water and animals in the container are stirred continuously. The dead specimens should be transferred to 10% formalin in seawater (one part commercial formalin and nine parts filtered seawater) for permanent preservation. Adding a narcotic prior to killing will improve the quality of the preserved specimens. In the laboratory the live animals can be narcotized for 10 to 15 minutes with 1% aqueous propylene phenoxetol added in drops to seawater in which the specimens are lying. The narcotized specimens are then killed with 10% formalin.

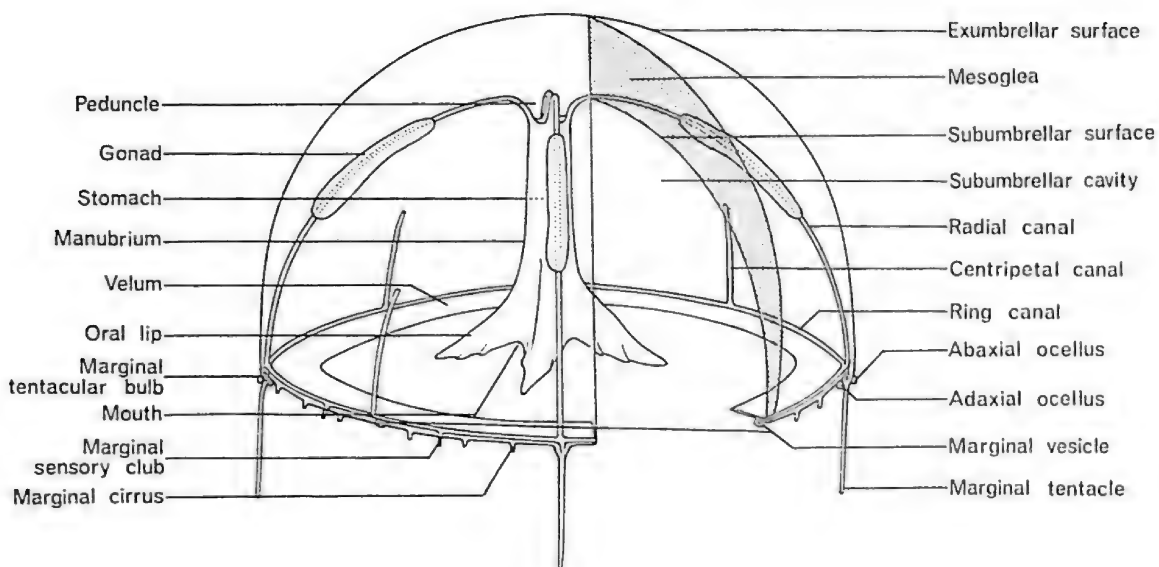


Figure 5
General structure of a hydromedusa with one quadrant cut away (modified from Russell 1953).

Class Hydrozoa

Cnidarians of the Class Hydrozoa (hī-drō-zō-a: aquatic animal) vary in their life cycles from those having polymorphic colonies to those having a single stage, either the medusa or polyp. Hydrozoans are generally characterized by the absence both of cells in the mesogloea and of nematocysts in the gastrodermis. Medusae of the Hydrozoa, or hydromedusae, have a circular velum projecting inward from the umbrella margin and have no stomodaeum (a portion of the digestive tract formed by the involution of ectoderm during development).

The hydromedusae display tetramerous or polymeric radial symmetry (Figures 5 and 6). A manubrium hangs from the centre of the subumbrella surface, and 4 or more radial canals extend within the umbrella from the central stomach to the peripheral ring canal. The umbrella margin bears tentacles that are either solitary or grouped in clusters, and sensory organs, such as ocelli (light sensing), statocysts (gravity sensing), and cordyli (club-like structures of uncertain function). Nerve bundles run around the margin connecting these sensory organs. The gonads are located either beneath the radial canals or around the manubrium. Although these characteristic features are present in most species of hydromedusae, there are numerous variations and modifications that should be taken into account when attempting to identify these animals. Siphonophores are highly polymorphic colonial forms. Their morphology will be discussed separately (p. 43).

The Hydrozoa live chiefly in the sea, but some, such as *Craspedacusta*, are successful inhabitants of fresh water. Planktonic hydrozoans of the Canadian Atlantic belong to five orders: Anthomedusae, Leptomedusae, Trachymedusae, Narcomedusae, and Siphonophora. The classification of the Hydrozoa remains controversial, primarily because scientists have not always been able to relate specific polyps to the medusae that are part of the same life cycle, and each form of one species may have been given a different name. The classification of medusae used here follows the system of Russell (1953) and Kramp (1961). It is a system based on the characteristics of the medusoid stage and is accepted by most scientists working in this field at the present time. Naumov (1960) proposed a different system that has put emphasis on the characteristics of the hydroid stage. The classification of siphonophores is based mainly on Totton (1965).

Key to Orders of Planktonic Hydrozoa

- 1a. Colonial forms composed of several kinds of polypoid and medusoid individuals Order Siphonophora (p. 43)
- 1b. Medusoid only 2
- 2a. Umbrella margin lobed; marginal tentacles leaving umbrella some distance above margin; no true radial canals Order Narcomedusae (p. 41)
- 2b. Umbrella margin without lobes; marginal tentacles leaving umbrella at margin; with radial canals 3
- 3a. Gonads usually on manubrium but occasionally extending to the proximal part of radial canals; no statocysts; usually with 4 radial canals but some with 8 or more; umbrella usually higher than wide Order Anthomedusae (p. 29)
- 3b. Gonads usually on radial canals but occasionally contiguous with the base of manubrium; with or without statocysts; with 4 or more radial canals 4
- 4a. Gonads on radial canals but occasionally contiguous with the base of manubrium; statocysts, if present, ectodermal; with 4 or more radial canals; umbrella usually wider than high Order Leptomedusae (p. 35)
- 4b. Gonads usually on radial canals; statocysts in part endodermal; with 4 or more radial canals; umbrella usually hemispherical or bell-shaped Order Trachymedusae (p. 40)

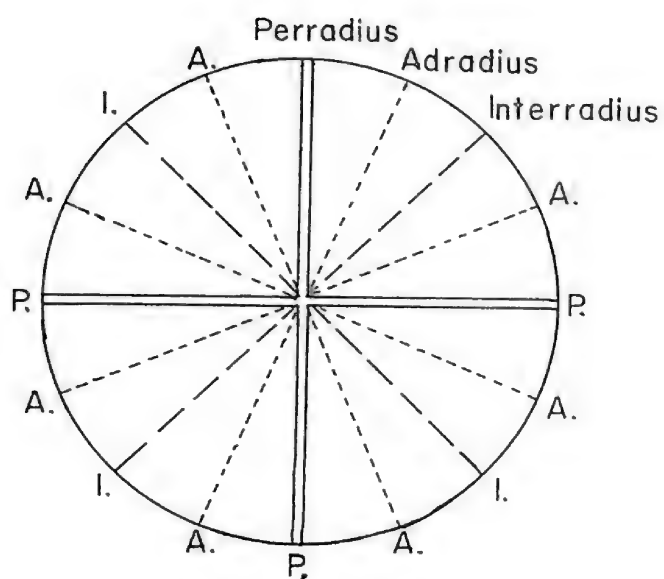


Figure 6
 Diagram to define the radii of a medusa (after Russell 1953):
 A. Adradii
 I. Interradii
 P. Perradii

Order Anthomedusae

(än-thō-mē-dū-sē: flower of medusa)

Hydrozoa with umbrella usually deep and bell-shaped; gonads almost invariably situated on manubrium, very rarely extending perradially on subumbrella; with or without ocelli; no statocysts.

Key to Genera of Anthomedusae

- 1a. Mouth simple and tubular 2
- 1b. Mouth with 4 oral lips or with oral tentacles 5
- 2a. Marginal tentacular bulbs with abaxial ocelli; 4 solitary marginal tentacles *Sarsia* Lesson (p. 30; Plates 1a, 1b)
- 2b. Marginal tentacular bulbs without ocelli; 4 or fewer marginal tentacles 3
- 3a. 4 equally developed marginal tentacles, each with a large terminal knob of nematocysts *Platocnide* Wagner (p. 31; Plate 2d)
- 3b. One to 4 marginal tentacles, usually unequally developed 4
- 4a. 4 marginal tentacular bulbs more or less of the same size, one to 4 unequally developed but similar solitary marginal tentacles *Euphysa* Forbes (p. 30; Plates 2a, 2b, 2c)
- 4b. One of the 4 marginal tentacular bulbs bearing one to 3 marginal tentacles, the other bulbs rudimentary *Hybocodon* L. Agassiz (p. 30; Plates 1c, 1d)
- 5a. Marginal tentacles in clusters 6
- 5b. Marginal tentacles solitary 8
- 6a. 8 clusters of marginal tentacles; mouth with 4 oral lips elongated to form oral arms *Rathkea* Brandt (p. 32; Plate 3c)
- 6b. 4 or rarely 8 clusters of marginal tentacles; mouth tubular with oral tentacles inserted above mouth opening 7
- 7a. Gonads on radial lobes of manubrium extending along radial canals; a median pair of tentacles with terminal knob in each cluster of marginal tentacles, the remaining tentacles threadlike *Nemopsis* L. Agassiz (p. 32; Plate 3f)
- 7b. Gonads on manubrium only; all marginal tentacles of the same kind *Bougainvillia* Lesson (p. 32; Plates 3d, 3e)
- 8a. Umbrella with 4 centripetal canals arising from the ring canal; marginal tentacles of 2 types, with and without terminal knob *Eumedusa* Bigelow (p. 34; Plate 5d)
- 8b. No centripetal canals 9
- 9a. Gonads on manubrium, without folds; clusters of nematocysts on oral lips *Podocoryne* M. Sars (p. 31; Plates 3a, 3b)
- 9b. Gonads on manubrium, with folds; no clusters of nematocysts on oral lips 10
- 10a. Apical projection of umbrella spherical 11
- 10b. Apical projection of umbrella in Gothic arch 12
- 11a. Radial canals narrow and smooth, or slightly jagged; marginal tentacles 8 or more *Halitholus* Hartlaub (p. 33; Plates 4b, 4c)
- 11b. Radial canals broad, heavily denticulated; marginal tentacles more than 8 *Catablema* Haeckel (p. 33; Plate, 4a)
- 12a. Gonads in 8 vertical adradial series with interradially directed horizontal folds and isolated pits on interradiial surface of stomach *Neoturris* Hartlaub (p. 34; Plate 5c)
- 12b. Gonads on interradiial surface with perradially directed folds and without isolated pits *Leuckartiara* Hartlaub (p. 33; Plates 5a, 5b)

FAMILY CORYNIDAE

(kor-īn-ī-dē: club-like shoot)

Anthomedusae with simple, circular mouth; 4 radial canals; gonads completely surrounding manubrium; 2 to 4 hollow marginal tentacles; ocelli abaxial.

Genus *Sarsia* Lesson 1843

(sar-sē-a: named after Sars)

Corynidae with gonads forming a single continuous ring or cylinder completely surrounding manubrium; marginal tentacles 4, equally developed.

Sarsia princeps (Haeckel 1879) (Plate 1a)

(prink-eps: chief)

Umbrella somewhat conical, up to 40 mm high; manubrium about as long as depth of subumbrella cavity, almost completely covered by gonads; radial canals with jagged edges; apical canal distinct, widened in its upper end; marginal tentacles long with numerous clusters of nematocysts.

Occurrence: Atlantic coast of Newfoundland; Grand Banks; Gulf of St. Lawrence.

Sarsia tubulosa (M. Sars 1835) (Plate 1b)

(tū-bū-lō-sa: tube-like)

Umbrella dome-like, higher than wide, up to 18 mm high; manubrium much longer than depth of subumbrella cavity, both ends free of gonads; radial canals not jagged; apical chamber distinct and globular; marginal tentacles long with numerous clusters of nematocysts.

Occurrence: Bay of Fundy; Atlantic coast of Newfoundland and Labrador; Gulf of St. Lawrence.

FAMILY TUBULARIIDAE

(tū-bū-lar-ē-ī-dē: tube-like)

Anthomedusae with or without nematocyst tracks on exumbrella; manubrium not extending beyond subumbrella cavity; mouth simple and circular; 4 radial canals; gonads completely surrounding manubrium; 4 or fewer marginal tentacles; no ocelli.

Genus *Euphysa* Forbes 1848

(ū-fī-sa: good breath)

Tubulariidae without nematocyst tracks on exumbrella; umbrella margin horizontal; marginal tentacles one to 4, unequally developed, all of the same structure and bead-like.

Euphysa aurata Forbes 1848 (Plate 2a)

(aw-rā-ta: gilded)

Umbrella up to 4 mm high; one marginal tentacle.

Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia; Gulf of St. Lawrence.

Euphysa flammea (Linko 1905) (Plate 2b)

(flām-ē-a: flame-coloured)

Umbrella up to 12 mm high and 7 mm wide; 4 marginal tentacles, all alike in adult, but developed in succession, youngest stages with only one.

Occurrence: Atlantic coast of Nova Scotia; Grand Banks.

Euphysa tentaculata Linko 1905 (Plate 2c)

(tēn-tā-kū-lā-ta: tentacular)

Umbrella up to 6 mm high; 3 marginal tentacles, one long and 2 half as long; one small non-tentacular marginal bulb opposite to the long marginal tentacle.

Occurrence: Atlantic coast of Nova Scotia; Gulf of St. Lawrence.

Genus *Hybocodon* L. Agassiz 1862

(hī-bō-kō-dōn: humped bell)

Tubulariidae with or without nematocyst tracks on exumbrella; umbrella margin oblique; one simple or compound marginal tentacular bulb with one to 3 marginal tentacles, and with or without medusa buds; 3 small non-tentacular marginal bulbs.

Hybocodon pendulus (L. Agassiz 1862) (Plate 1c) (pēn-dūl-ūs: hanging)
Umbrella 5 mm high; 5 vertical nematocyst tracks on exumbrella; marginal tentacular bulb with one long and usually 2 short bead-like marginal tentacles, and without medusa buds.

Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia; Gulf of St. Lawrence.

Hybocodon prolifer L. Agassiz 1862 (Plate 1d) (prō-lī-fer: offspring-bearing)
Umbrella up to 4 mm high and 3 mm wide; 5 nematocyst tracks on exumbrella; marginal tentacular bulb with one or more bead-like marginal tentacles, and with medusa buds, at least in immature stage.

Occurrence: Bay of Fundy; Atlantic coast of Newfoundland.

Genus ***Plotocnide*** Wagner 1885 (plō-tō-knī-dē: floating nettle)
Tubulariidae with 4 marginal tentacles, each with a large terminal knob of nematocysts.

Plotocnide borealis Wagner 1885 (Plate 2d) (bor-ē-āl-īs: northern)
Umbrella up to 3 mm high and almost as wide; no peduncle, marginal tentacles with terminal knob of nematocysts.

Occurrence: Gulf of St. Lawrence.

FAMILY HYDRACTINIIDAE (hī-drāk-tīn-ē-ī-dē: serpent's ray)

Anthomedusae with or without peduncle; mouth with simple or branching oral lips armed with terminal clusters of nematocysts; 4 radial canals; gonads either only on interradial walls of manubrium, or also on proximal portions of radial canals; 4, 8 or more solid marginal tentacles; ocelli present or absent.

Genus ***Podocoryne*** M. Sars 1846 (pōd-ō-kor-ī-nē: clubfoot)
Hydractiniidae with manubrium not extending beyond subumbrella cavity; peduncle present or absent; gonads on interradial walls of manubrium; 4 or more solid marginal tentacles; no ocelli.

Podocoryne americana Mayer 1910 (Plate 3b) (ă-mer-ī-kān-a: American)
Umbrella 1–3.5 mm in height and width; manubrium flask-shaped; oral lips unbranched, each with one cluster of nematocysts; marginal tentacles up to 32.
Occurrence: Bay of Fundy.

Remarks: This species was listed as ***Podocoryne carnea*** in Shih (1971). The change to the present name is based on Edwards (1972).

Podocoryne borealis (Mayer 1900) (Plate 3a) (bor-ē-āl-īs: northern)
Umbrella up to 5 mm in height and width; manubrium long and tubular; oral lips branched 1–2 times in older specimens, each branch with a terminal knob of nematocysts; 16–32 marginal tentacles.
Occurrence: Bay of Fundy.

FAMILY RATHKEIDAE (rāth-kē-ī-dē: named after Rathke)

Anthomedusae with manubrium not extending beyond subumbrella cavity; with or without peduncle; mouth with 4 oral lips armed with terminal and lateral nematocyst clusters; gonads completely surrounding manubrium; medusa buds on manubrium present or absent; 4 (rarely 8) radial canals; 8 groups of marginal tentacles; no ocelli.

Genus **Rathkea** Brandt 1838

(răth-kē-a: named after Rathke)

Rathkeidae with or without small apical projection; with or without peduncle; 4 radial canals.

Rathkea octopunctata (M. Sars 1835) (Plate 3c) (ök-tō-pŭnk-tā-ta: with eight points)

Umbrella 3–4 mm high and 2–4.5 mm wide, pear-shaped with small apical projection; with peduncle; each oral lip with one to 2 pairs of nematocyst knobs; 3 to 5 marginal tentacles in each cluster.

Occurrence: Atlantic coast of Newfoundland; Strait of Belle Isle; Gulf of St. Lawrence.

FAMILY BOUGAINVILLIIDAE

(boo-găn-vīl-ē-ī-dē: named after Bougainville)

Anthomedusae with short manubrium not extending beyond umbrella margin; with or without peduncle; mouth simple, tubular, with simple or dichotomously branching oral tentacles inserted above mouth opening; 4 radial canals; gonads interradial or adradial, or completely surrounding manubrium; 2, 4, or more solitary marginal tentacles, or 4, 8, or 16 large marginal tentacular bulbs, each with a group of solid marginal tentacles; ocelli present or absent.

Genus **Bougainvillia** Lesson 1836

(boo-găn-vīl-ya: named after Bougainville)

Bougainvilliidae with or without peduncle; 4 perradial, dichotomously branching oral tentacles; gonads interradial or adradial; 4 radially placed clusters of marginal tentacles, the tentacles of each cluster being all of one kind and similar in structure; ocelli present or absent.

Bougainvillia principis (Steenstrup 1850) (Plate 3d)

(prīnk-ī-pīs: chief)

Umbrella height and width up to 10 mm; umbrella wall with moderately thick jelly; manubrium without peduncle; oral tentacles divided 5–6 times; gonads adradial; 30–40 marginal tentacles in each cluster.

Occurrence: Atlantic coast of Labrador.

Bougainvillia superciliaris (L. Agassiz 1849) (Plate 3e)

(sū-per-sīl-ē-ar-īs:
eyebrow-like)

Umbrella height and width 7–9 mm; umbrella with very thick jelly; manubrium with well-developed peduncle; oral tentacles divided 4–5 (rarely 6–7) times; gonads interradial; 11–15 marginal tentacles in each cluster.

Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia, Newfoundland, and Labrador; Strait of Belle Isle.

Genus **Nemopsis** L. Agassiz 1849

(nēm-ōp-sīs: threadlike appearance)

Bougainvilliidae without peduncle; 4 perradial, dichotomously branching oral tentacles; stomach with 4 radial lobes extending outwards along radial canals; gonads on these lobes; 4 clusters of marginal tentacles, in each cluster a median pair of tentacles with terminal knob and on both sides a number of simple, threadlike tentacles; ocelli adaxial.

Nemopsis bachei L. Agassiz 1849 (Plate 3f)

(bak-ē-ī: named after Bach)

Umbrella dome-shaped, up to 11 mm high; umbrella wall with thick jelly; oral tentacles divided 5–7 times; 14–18 marginal tentacles in each cluster.

Occurrence: Bay of Fundy.

FAMILY PANDEIDAE (păn-dē-ī-dē: named after Pandean, ancient Greek god of woods and shepherds)

Anthomedusae with umbrella with or without apical projection; manubrium large; peduncle usually absent; mouth with 4 simple or crenulated oral lips; with 4 (rarely 8) radial canals; centripetal canals rarely present; simple or folded gonads adradially or interrally on manubrium, sometimes extending along radial canals; hollow marginal tentacles without terminal knob of nematocysts; marginal tentacular bulbs conical, usually laterally compressed; rudimentary marginal tentacles and marginal warts present or absent; abaxial ocelli present or absent.

Genus *Catablema* Haeckel 1879 (kā-ta-blēm-a: curtain)
Pandeidae with apical projection; manubrium large, with broad base attached to subumbrella with 4 strips of membraneous tissue; no peduncle; mouth with 4 large crenulated oral lips; 4 radial canals broad and denticulated; no centripetal canals; gonads on manubrium broadly separated perradially, reticulate, with irregular folds issuing from perradial sides; marginal tentacles numerous.

Catablema vesicarium (A. Agassiz 1862) (Plate 4a) (vēs-ī-kar-ē-ūm: bladderwort)
Umbrella up to 25 mm wide and 30 mm high; gonads irregularly folded with densely reticulate surfaces; marginal tentacles up to about 32.
Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia; Newfoundland and Labrador.

Genus *Halitholus* Hartlaub 1913 (hā-lī-thōl-ūs: vault of the sea)
Pandeidae with apical projection; manubrium cubical; no peduncle; oral lips faintly crenulated; radial canals not or slightly jagged; folded gonads horseshoe-shaped; marginal tentacles 8 or more.

Halitholus cirratus Hartlaub 1913 (Plate 4b) (sīr-āt-us: curled)
Umbrella up to 16 mm in height and 14 mm in width; apical projection large and globular; manubrium nearly as long as depth of subumbrella cavity; marginal tentacles about 40; no ocelli.
Occurrence: Atlantic coast of Labrador.

Halitholus pauper Hartlaub 1913 (Plate 4c) (paw-per: meagre)
Umbrella up to 10 mm high and 9 mm wide; apical projection low and rounded; manubrium extending about half of depth of subumbrella cavity; 4 large perradial and 4 small interrally marginal tentacles, and a few small rudimentary bulbs; ocelli small.
Occurrence: Atlantic coast of Nova Scotia.

Genus *Leuckartiara* Hartlaub 1913 (lū-kart-ī-ar-a: named after Leuckart)
Pandeidae with apical projection; large manubrium attached to radial canals by membraneous tissue; oral lips folded or crenulated; radial canals broad, often jagged; gonads interrally on manubrium, horseshoe-shaped with folds directed perradially; marginal tentacles numerous, with elongated, laterally compressed marginal tentacular bulbs; rudimentary marginal tentacles often present; abaxial ocelli present or absent.

Leuckartiara nobilis Hartlaub 1913 (Plate 5a) (nō-bīl-īs: noble)
Umbrella up to 27 mm high and 20 mm wide; radial canals broad with short lateral diverticula; marginal tentacles 24–40 of different sizes, none permanently rudimentary; ocelli dark red.
Occurrence: Atlantic coast of Newfoundland.

Leuckartiara octona (Fleming 1823) (Plate 5b) (ōk-tōn-a: of eight parts)
Umbrella up to 20 mm high, higher than wide; radial canals smooth or slightly jagged; marginal tentacles 12–24, usually 16, plus 16 or more club-shaped rudimentary marginal tentacles; ocelli red.
Occurrence: Bay of Fundy; Gulf of St. Lawrence.

Genus ***Neoturris*** Hartlaub 1913 (nē-ō-tūr-is: new tower)
Pandeidae with apical projection, sometimes much reduced; manubrium large and wide and attached to subumbrella with membraneous tissue; oral lips folded and crenulated; radial canals broad, ribbon-like and jagged; gonads covering interradial surfaces of manubrium, with adradial horizontal folds directed interradially and isolated pits located interradially; 8 or more marginal tentacles with laterally compressed marginal tentacular bulbs; no rudimentary marginal tentacles or marginal warts.

Neoturris pileata (Forskål 1775) (Plate 5c) (pī-lē-at-a: wearing a felt cap)
Umbrella up to 40 mm high and 25 mm wide; apical projection sometimes much reduced; manubrium attached to proximal half of radial canals with membraneous tissue; gonads in numerous round pits on interradial walls of manubrium between adradial series of transverse folds; marginal tentacles numerous, usually 60–80; no ocelli.
Occurrence: Atlantic coast of Newfoundland.

FAMILY CALYCOPSIDAE (kā-lī-kōp-sī-dē: budding flower)

Anthomedusae without peduncle; mouth with 4 simple or crenulated oral lips; 4 or 8 simple or branched radial canals; centripetal canals present or absent; simple or folded gonads on manubrium; 8 or more hollow marginal tentacles without marginal tentacular bulbs and each with a terminal knob of nematocysts; rudimentary or dwarf marginal tentacles present or absent; ocelli present or absent.

Genus ***Eumedusa*** Bigelow 1920 (ū-mē-dū-sa: true medusa)
Calycopsidae with 4 simple oral lips; 4 simple radial canals; 4 centripetal canals; gonads irregularly folded on manubrium; large hollow marginal tentacles with rings of nematocysts and a terminal knob and small marginal tentacles present.

Eumedusa birulai (Linko 1913) (Plate 5d) (bī-ru-lā-ī: named after Birula)
Umbrella up to 13 mm high and 10 mm wide; 4 interradial centripetal canals joining base of stomach in adults; 8 or 16 large hollow marginal tentacles and numerous small solid marginal tentacles.
Occurrence: Atlantic coast of Newfoundland.

Order Leptomedusae

(lěp-tō-mē-dū-sē: delicate medusae)

Hydrozoa with hemispherical or flattened umbrella; gonads confined to radial canals or on radial canals but contiguous with manubrium; marginal sensory organs, when present, in form of cordyli or marginal vesicles, or occasionally ocelli.

Key to Genera of Leptomedusae

- 1a. Marginal vesicles present 2
- 1b. No marginal vesicles 10
- 2a. Marginal cirri present 3
- 2b. No marginal cirri 5
- 3a. 12–16 radial canals arranged in 4 groups *Halopsis* A. Agassiz (p. 37; Plate 7b)
- 3b. 4 radial canals 4
- 4a. Oral lips slightly folded; marginal cirri spiral *Mitrocomella* Haeckel (p. 37; Plate 7c)
- 4b. Oral lips crenulated; marginal cirri straight *Cosmetira* Forbes (p. 37; Plate 7a)
- 5a. 4 radial canals 6
- 5b. Radial canals more than 16 9
- 6a. Marginal vesicles open; ocelli present *Tiaropsis* L. Agassiz (p. 38; Plate 7d)
- 6b. Marginal vesicles closed; no ocelli 7
- 7a. Peduncle thick and long; gonads on entire length of radial canals *Tima* Eschscholtz (p. 39; Plate 8e)
- 7b. No peduncle; gonads extending part way along radial canals 8
- 8a. Velum normal; marginal tentacles hollow *Phialidium* Leuckart (p. 38; Plates 8b, 8c, 8d)
- 8b. Velum reduced; marginal tentacles solid *Obelia* Péron and Lesueur (p. 38; Plate 8a)
- 9a. Manubrium short, not extending below umbrella margin; no subumbrella gelatinous papillae *Aequorea* Péron and Lesueur (p. 39; Plates 9a, 9b)
- 9b. Manubrium extending below umbrella margin; with subumbrella gelatinous papillae *Rhacostoma* L. Agassiz (p. 39; Plate 9c)
- 10a. 4 radial canals; gonads on radial canals continuous with manubrium; cordyli present 11
- 10b. Radial canals more than 4; gonads on radial canals separated from manubrium; no cordyli 13
- 11a. Radial canals with lateral diverticula *Ptychogena* A. Agassiz (p. 37; Plate 6d)
- 11b. Radial canals simple 12
- 12a. Manubrium cross-shaped, with mouth opening extending for considerable distance along course of each radial canal *Staurophora* Brandt (p. 37; Plate 6e)
- 12b. Manubrium small, with 4 simple crenulated oral lips *Laodicea* Lesson (p. 36; Plate 6c)
- 13a. Radial canals 5–18, not regularly arranged; adaxial ocelli present *Dipleurosoma* Boeck (p. 36; Plate 6a)
- 13b. 8 radial canals; no ocelli *Melicertum* L. Agassiz (p. 36; Plate 6b)

FAMILY DIPLEUROSOMATIDAE (dī-plūr-ō-sōm-ā-tī-dē: double-sided body)

Leptomedusae with manubrium with narrow base; 3, 4, or more radial canals simple or branched; gonads on radial canals separated from manubrium; marginal tentacles hollow; no marginal cirri; no marginal vesicles; ocelli present or absent.

Genus *Dipleurosoma* Boeck 1866 (dī-plūr-ō-sōm-a: double-sided body)
Dipleurosomatidae with 3 or more main radial canals, some or all of which branch irregularly and join the ring canal; gonads on radial canals adjacent to manubrium; marginal tentacles numerous; ocelli present or absent.

Dipleurosoma typicum Boeck 1866 (Plate 6a) (tīp-īk-ūm: typical)
Umbrella up to 12 mm wide, wider than high; manubrium short; 5–18 radial canals, simple or irregularly branched; 1–12 gonads, most frequently 5; more than 100 marginal tentacles; adaxial ocelli present.
Occurrence: Atlantic coast of Newfoundland.

FAMILY MELICERTIDAE (mēl-ī-sert-ī-dē: named after Melicerta, sea god in Greek mythology)

Leptomedusae with 8 simple or bifurcated radial canals; gonads on radial canals separated from manubrium; marginal tentacles hollow; no marginal cirri and marginal vesicles; ocelli present or absent.

Genus *Melicertum* L. Agassiz 1862 (mēl-ī-sert-ūm: named after Melicerta, sea god in Greek mythology)
Melicertidae with 8 simple radial canals; usually without ocelli.

Melicertum octocostatum (M. Sars 1835) (Plate 6b) (ōk-tō-kōst-āt-ūm: eight-ribbed)
Umbrella up to 14 mm in height and width, conical to pyriform; velum narrow; manubrium short and broad; 8 sinuous gonads extending almost the whole course of radial canals; up to 72 large marginal tentacles alternating with as many small ones; no ocelli.
Occurrence: Bay of Fundy; Atlantic coast of Newfoundland; Grand Banks.

FAMILY LAODICEIDAE (lā-ō-dīk-ē-ī-dē: named after Laodicea, a city of Phrygia)

Leptomedusae with mouth squared with 4 oral lips, or rarely large, cross-shaped; 4 to 8 or more radial canals, simple or branched; gonads on radial canals contiguous with manubrium; marginal tentacles hollow; marginal cirri present or absent; cordyli present; no marginal vesicles; ocelli present or absent.

Genus *Laodicea* Lesson 1843 (lā-ō-dīk-ē-a: named after Laodicea, a city of Phrygia)
Laodiceidae with small manubrium; oral lips 4, crenulated; 4 radial canals; gonads wavy; marginal cirri present or absent; ocelli adaxial.

Laodicea undulata (Forbes and Goodsir 1853) (Plate 6c) (un-dū-lā-ta: wavy)
Umbrella up to 37 mm wide, wider than high; manubrium square and short; 4 long sinuous gonads on radial canals contiguous with manubrium; up to 600 marginal tentacles; usually one cordylus between successive marginal tentacles; marginal cirri spiral, usually one between two successive marginal tentacles; adaxial ocellus usually on each third to fifth marginal tentacle.
Occurrence: Atlantic coast of Newfoundland; Grand Banks.

Order Leptomedusae

Genus *Ptychogena* A. Agassiz 1865 (tī-kō-jēn-a: wrinkled cheek)
Laodiceidae with funnel-shaped oral lips; 4 radial canals with lateral diverticula;
gonads on diverticula of radial canals; no marginal cirri and ocelli.

Ptychogena lactea A. Agassiz 1865 (Plate 6d) (lāk-tē-a: milky)
Umbrella thick, up to 90 mm wide, 30 mm high; manubrium short and square; 4
short crenulated oral lips; radial canals with 20–30 pairs of lateral folds; marginal
tentacles up to 300–500; club-shaped cordyli as numerous as marginal tenta-
cles.
Occurrence: Passamaquoddy Bay; St. Lawrence estuary.

Genus *Staurophora* Brandt 1838 (stawr-ōf-er-a: cross-bearer)
Laodiceidae with cross-shaped manubrium; mouth-opening extending for con-
siderable distance along course of each radial canal; 4 radial canals; gonads in
branched diverticula in lateral walls of manubrium; no marginal cirri; ocelli
adaxial.

Staurophora mertensi Brandt 1838 (Plate 6e) (mer-tens-ī: named after Mertens)
Umbrella up to 200 mm wide, wider than high; up to 4,400 marginal tentacles;
cordyli alternating with marginal tentacles.
Occurrence: Bay of Fundy; Atlantic coast of Newfoundland; Gulf of St. Law-
rence.

FAMILY MITROCOMIDAE (mī-trō-kōm-ī-dē: banded hair)

Leptomedusae with 4, rarely 8, oral lips; 4, 8, or more simple radial canals; go-
nads on radial canals separated from manubrium; marginal tentacles hollow;
marginal cirri present or absent; marginal vesicles open; ocelli present or ab-
sent.

Genus *Cosmetira* Forbes 1848 (koz-mēt-īr-a: well-shaped)
Mitrocomidae with 4 slightly folded oral lips; 4 radial canals; gonads linear; mar-
ginal cirri usually straight in large specimens but may be spirally coiled in young
ones; 8 marginal vesicles; no ocelli.

Cosmetira sp.
The species identity was not given in the original record. (A. Agassiz 1865 in
Shih 1971). It is very likely that it belongs to *Cosmetira pilosella* Forbes 1848
(Plate 7a) (pīl-ō-sēl-a: slightly hairy) the only known species of this genus.
Occurrence: Gulf of St. Lawrence.

Genus *Halopsis* A. Agassiz 1863 (hāl-ōp-sīs: appearance of sea)
Mitrocomidae with 4 slightly folded oral lips; radial canals 8 or more; gonads line-
ar; marginal cirri spiral; marginal vesicles numerous; no ocelli.

Halopsis ocellata A. Agassiz 1863 (Plate 7b) (ōs-ēl-āt-a: with small eyes)
Umbrella up to 65 mm wide, about 4 times as wide as high; manubrium short and
wide; 12–16 radial canals in 4 groups; gonads along two-thirds of the length of
radial canals; marginal tentacles up to about 450; marginal cirri alternating with
marginal tentacles; about 80 marginal vesicles.
Occurrence: Bay of Fundy.

Genus *Mitrocomella* Haeckel 1879 (mī-trō-kōm-ēl-a: small hair-band)
Mitrocomidae with 4 simple oral lips; 4 radial canals; gonads linear or oval; mar-
ginal cirri spiral; 8–16 marginal vesicles; no ocelli.

Mitrocomella polydiademata (Romanes 1876) (Plate 7c) (pöl-ē-dī-a-dēm-āt-a: many diadems)

Umbrella up to 30 mm wide; manubrium wide and short; marginal tentacles 36 – 34; 5 – 9 marginal cirri between successive tentacles; 16 marginal vesicles.
Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia.

Genus ***Tiaropsis*** L. Agassiz 1849 (tē-ar-öp-sīs: turban-like)
Mitrocomidae with 4 folded oral lips; 4 radial canals; gonads linear; no marginal cirri; 8 marginal vesicles; ocelli present.

Tiaropsis multicirrata (M. Sars 1835) (Plate 7d) (mül-tī-ser-āt-a: much curled)
Umbrella up to 20 mm wide, wider than high; with short, broad peduncle; gonads slightly sinuous; marginal tentacles short, up to about 300.
Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia and Newfoundland; Grand Banks; Strait of Belle Isle; Gulf of St. Lawrence.

FAMILY CAMPANULARIIDAE (kām-pān-ū-lar-ē-ī-dē: bell-shaped)

Leptomedusae with normal or reduced velum; manubrium small; no peduncle; 4 simple radial canals; gonads on radial canals separated from manubrium; marginal tentacles hollow, rarely solid; no marginal cirri; marginal vesicles closed; no ocelli.

Genus ***Obelia*** Péron and Lesueur 1809 (ō-bēl-ya: pointed)
Campanulariidae with flat umbrella with thin jelly; velum reduced; manubrium short, with square base; mouth with 4 short, simple oral lips; 4 simple radial canals; gonads round or oval, on middle of radial canals; numerous short, solid marginal tentacles; no marginal cirri; 8 closed marginal vesicles; no ocelli.

Obelia spp. (Plate 8a)
Species of this genus are very similar and cannot be specifically identified. They are small, with umbrella up to 6 mm wide.
Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia and Newfoundland; Cabot Strait; Strait of Belle Isle; Gulf of St. Lawrence.

Genus ***Phialidium*** Leuckart 1856 (fī-a-līd-ē-ūm: flat bowl)
Campanulariidae with flat to hemispherical umbrella; velum normal; marginal tentacles hollow; marginal vesicles numerous.

Phialidium bicophorum (L. Agassiz 1862) (Plate 8b) (bī-kōf-er-ūm: bearing an earthen wine vessel)
Umbrella up to 5.5 mm wide, 2 – 3 times as wide as high; manubrium small; 4 small simple oral lips; gonads spindle-shaped, in middle quarter of radial canals; 16 marginal tentacles; 16 marginal vesicles.
Occurrence: Bay of Fundy.

Phialidium folleatum (McCrary 1857) (Plate 8c) (fol-ē-āt-ūm: shaped like a bag)
Umbrella up to 5 mm wide, hemispherical or somewhat flatter; manubrium small; 4 short oral lips slightly recurved; gonads oval, on distal region of radial canals; marginal tentacles 16, rarely more; marginal vesicles alternating with marginal tentacles.
Occurrence: Atlantic coast of Nova Scotia.

Order Leptomedusae

Phialidium languidum (A. Agassiz 1862) (Plate 8d) (lång-wīd-ūm: feeble)
Umbrella up to 20 mm wide, wider than high; manubrium small and tubular; 4 simple, recurved oral lips; gonads linear along distal half of radial canals; marginal tentacles 32 or more; usually 2 marginal vesicles between two tentacles.
Occurrence: Bay of Fundy.

FAMILY EUTIMIDAE

Leptomedusae with small stomach; with distinct peduncle; 4 simple radial canals; gonads on radial canals, either on peduncle or subumbrella only, or on both; marginal tentacles hollow; no marginal cirri; marginal vesicles closed; no ocelli.

Genus *Tima* Eschscholtz 1829

Eutimidae with gonads on entire length of radial canals; marginal vesicles more than 8; numerous marginal warts.

Tima formosa L. Agassiz 1862 (Plate 8e)

Umbrella up to 100 mm wide, 65 mm high; peduncle as long as umbrella width; oral lips large; marginal tentacles about 32; about 3 marginal warts and 4 marginal vesicles between successive marginal tentacles.
Occurrence: Gulf of St. Lawrence.

FAMILY AEQUOREIDAE

Leptomedusae with broad manubrium; peduncle usually absent; 8 or more simple or branched radial canals; gonads on radial canals separated from manubrium; marginal tentacles hollow; no marginal cirri; marginal vesicles closed; ocelli present or absent.

Genus *Aequorea* Péron and Lesueur 1809

Aequoreidae with short manubrium not extending below umbrella margin; usually without peduncle; radial canals numerous, simple; subumbrella without rows of papillae.

Aequorea albida A. Agassiz 1862 (Plate 9a)

Umbrella up to 60 mm wide; base of manubrium about one-third to one-half as wide as umbrella; 80 – 100 radial canals; gonads extending along almost whole length of radial canals; 2 – 3 small marginal bulbs between successive marginal tentacles.
Occurrence: Bay of Fundy.

Aequorea vitrina Gosse 1853 (Plate 9b)

Umbrella up to 170 mm wide, flatter than a hemisphere; base of manubrium about half as wide as umbrella; 60 – 100 radial canals; gonads extending along almost whole length of radial canals; marginal tentacles always more than 3 times the number of radial canals; partially developed marginal tentacles and few marginal bulbs present.
Occurrence: Gulf of St. Lawrence.

Genus *Rhacostoma* L. Agassiz 1850

Aequoreidae with manubrium extending below umbrella margin; no peduncle; numerous simple radial canals; subumbrella with radial rows of gelatinous papillae.

Rhacostoma atlanticum L. Agassiz 1850 (Plate 9c) (ăť-lăn-tik-ŭm: Atlantic)
Umbrella up to 400 mm wide, 3 – 4 times as wide as high; base of manubrium one-third to one-half of umbrella width; 80 – 100 radial canals; gonads extending greater part of radial canals; marginal tentacles slightly more numerous than radial canals.

Occurrence: Bay of Fundy.

Order Trachymedusae (tră-kē-mē-dŭ-sē: rough medusae)

Hydrozoa with hemispherical or deep bell-shaped umbrella; radial canals 4, 8, or more; gonads usually confined to radial canals; marginal tentacles solid, or both solid and hollow; marginal sensory clubs free or enclosed.

Key to Genera of Trachymedusae

- 1a. All marginal tentacles alike, each with two distinct regions: soft, flexible proximal and stiff, spine-like distal; manubrium rudimentary, with a circular mouth lacking oral lips ***Halicreas*** Fewkes (p. 41; Plate 10b)
- 1b. Marginal tentacles without distinct proximal and distal regions; manubrium well developed; mouth with 4 oral lips 2
- 2a. Marginal tentacles grouped in clusters, each cluster with 2 kinds of tentacles: 3 solid and threadlike, and numerous others with adhesive discs; exumbrella with 16 radiating ridges; gonads on the sides of manubrium lobes or on radial canals near manubrium lobes ***Ptychogastria*** Allman (p. 40; Plate 10a)
- 2b. Marginal tentacles solitary and all alike; eight sausage-like gonads hanging from the subumbrella portion of radial canals; gonads on radial canals or hanging as pouches into subumbrella cavity ***Aglantha*** Haeckel (p.41; Plate 10c)

FAMILY PTYCHOGASTRIIDAE (tī-kō-gās-trē-ī-dē: folded belly)

Trachymedusae with manubrium with 8 lobes, each lobe attached to subumbrella with membranous tissue; 8 radial canals; gonads on the sides of manubrium lobes or on radial canals near manubrium lobe; marginal tentacles grouped into clusters; some marginal tentacles with adhesive discs; marginal sensory clubs free.

Genus ***Ptychogastria*** Allman 1878 (tī-kō-gās-trē-a: folded belly)
With the characters of the family.

Ptychogastria polaris Allman 1878 (Plate 10a) (pō-lar-īs: polar)
Umbrella up to 22 mm wide, hemispherical or slightly conical; exumbrella with 16 radiating ridges; velum wide; manubrium about half as deep as subumbrella cavity; 4 oral lips; 8 centripetal canals may be present; 16 separated gonads along the sides of manubrium lobes; about 48 clusters of solid marginal tentacles, each cluster with 3 threadlike tentacles and numerous others with adhesive discs; 16 marginal sensory clubs.
Occurrence: Atlantic coast of Nova Scotia and Labrador.

FAMILY HALICREATIDAE (hă-lī-krē-ăt-ī-dē: named after Halicrion, lord of the sea in Greek mythology)

Trachymedusae with circular manubrium; no peduncle; 8 or more broad radial canals; gonads on radial canals; marginal tentacles alike, each divided into soft, flexible proximal and a stiff, spine-like distal region; marginal sensory clubs free.

Order Narcomedusae

Genus *Halicreas* Fewkes 1882 (hāl-ī-krē-as: named after Halicrion, lord of the sea in Greek mythology)
Halicreatidae with 8 radial canals; perradial gelatinous papillae on exumbrella.

Halicreas minimum Fewkes 1882 (Plate 10b) (mīn-ī-mum: smallest)
Umbrella up to 40 mm wide, disc-like, with a conical apical projection; gonads oval; marginal tentacles up to 640; 3 to 4 marginal sensory clubs between successive radial canals.
Occurrence: Atlantic coast of Nova Scotia.

FAMILY RHOPALONEMATIDAE (rō-pal-ō-nē-māt-ī-dē: threaded club)

Trachymedusae with narrow manubrium with or without peduncle; radial canals 8, rarely more; no centripetal canals; gonads on radial canals or hanging as pouches into subumbrella cavity; marginal tentacles all alike or of two kinds, evenly distributed round umbrella margin or arranged in groups; marginal sensory clubs free, rarely enclosed.

Genus *Aglantha* Haeckel 1879 (äg-lānth-a: shine)
Rhopalonematidae with deep bell-shaped umbrella; peduncle well developed; 4 oral lips; 8 radial canals; gonads on radial canals or hanging as pouches into subumbrella cavity; marginal tentacles numerous, all alike; marginal sensory clubs free.

Aglantha digitale (O.F. Müller 1776) (Plate 10c) (dīj-ī-tāl-ē: fingered)
Umbrella up to 40 mm high, half as wide as high; peduncle slender, almost as long as subumbrella cavity; gonads pouch-like, hanging from radial canals close to base of peduncle; marginal tentacles 80 or more; 8 marginal sensory clubs.
Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia, Newfoundland and Labrador; Strait of Belle Isle; Gulf of St. Lawrence.

Order Narcomedusae (nar-kō-mē-dū-sē: numbed medusae)

Hydrozoa with sides of umbrella divided by peronia so that umbrella margin may be lobed; broad stomach with entire circular periphery or with rectangular peripheral gastric pouches; no radial canals; peripheral canal system present or absent; gonads on stomach walls; marginal tentacles solid, coming off umbrella some distance above margin, and sometimes small secondary marginal tentacles on margin itself; marginal sensory clubs free.

FAMILY AEGINIDAE (ē-jīn-ī-dē: named after Aegina, Greek mythology)

Narcomedusae with interrarial, divided gastric pouches containing gonads; with or without peripheral canal system; marginal tentacles leaving umbrella between gastric pouches; secondary marginal tentacles present or absent.

Genus *Aeginopsis* Brandt 1835 (ē-jīn-ōp-sīs: appearance of *Aegina*)
Aeginidae with 16 gastric pouches; no peripheral canal system; 4 marginal tentacles; 8 peronia; no secondary marginal tentacles.

Aeginopsis laurentii Brandt 1838 (Plate 10d) (law-rēn-tē-ī: Laurent's)
Umbrella up to 25 mm wide, hemispherical or slightly conical; 2 – 3 marginal sensory clubs in between successive peronia.
Occurrence: Atlantic coast of Newfoundland and Labrador; Grand Banks; Gulf of St. Lawrence.

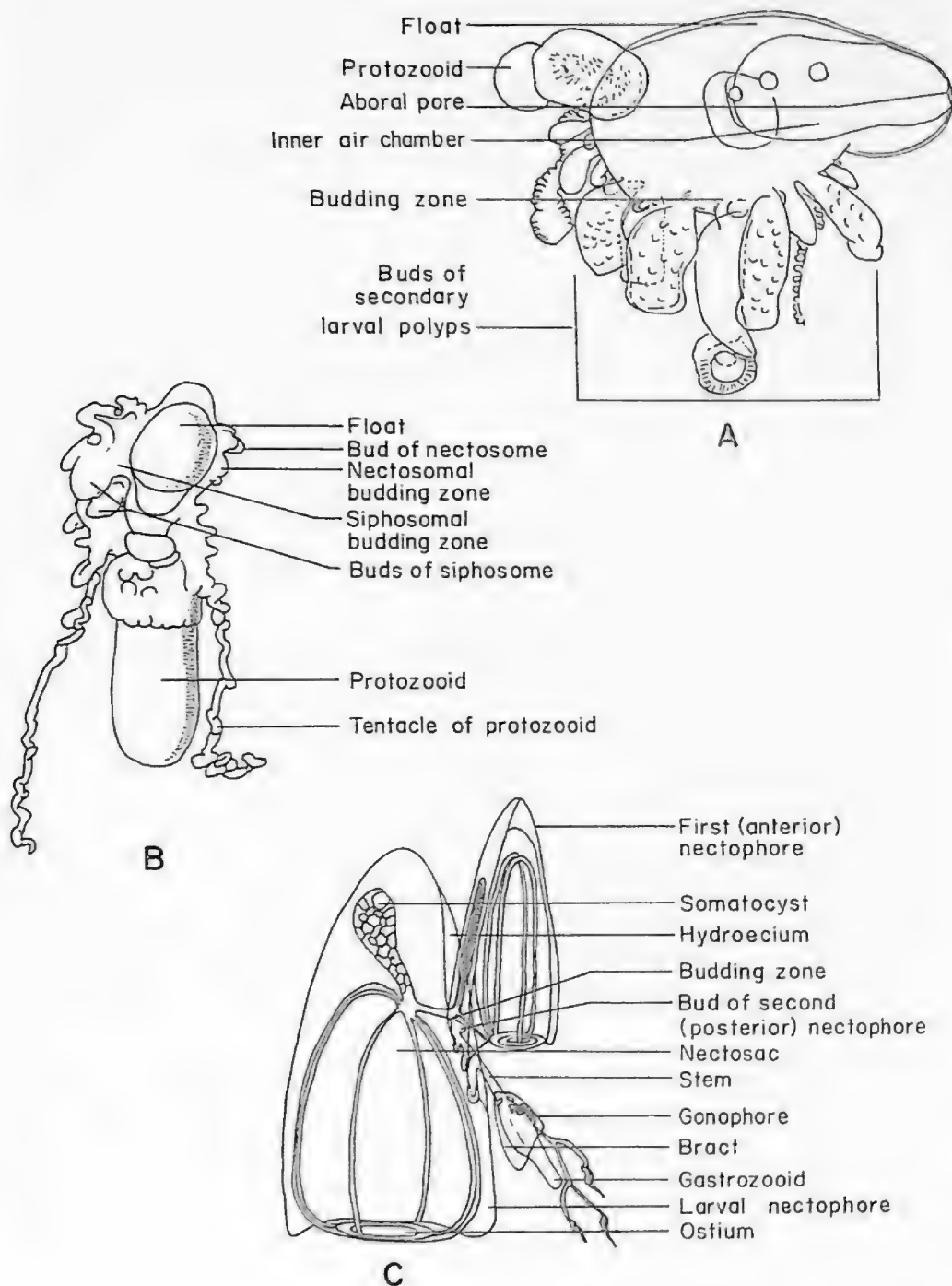


Figure 7
Three basic forms of siphonophore larvae and their budding (after Totton 1965):
A. Cystonect larva, *Physalia physalis*
B. Physonect larva, *Nanomia bijuga*
C. Calyophore larva, *Chelophyes appendiculata*

Order Siphonophora

(sī-fōn-ō-for-a: siphon bearer)

The Siphonophora are an order of modified hydrozoan colonies composed of several kinds of highly polymorphic polypoid and medusoid individuals with specialized functions. A siphonophore is formed by a juvenile and asexual oozoid polyp, which directly or indirectly gives rise to individuals of the colony by budding (Figure 7).

An oozoid is made up of a protozoid (including the stem) and a float. The protozoid, also known as primary or terminal gastrozoid, is the gastrozoid at the oral end of the juvenile siphonophore and in some mature cystonect and physonect siphonophores. The float or pneumatophore is an aboral, invaginated, and saclike structure of the oozoid. The stem, or coenosarc, is the part of the protozoid that buds off other individuals of the colony. In forms that bud nectophores from the stem, the stem is divided into nectosome (the part bearing the nectophores) and the siphosome, which bears the other individuals. Such forms have 2 budding zones, one for the nectosome and one for the siphosome. The new individuals that arise from the stem may be classified into 2 categories, polypoid or medusoid derivatives.

Polypoid derivatives or secondary polypoids comprise gastrozooids, palpons, and bracts. Palpons resemble gastrozooids, but are usually smaller and do not ingest food, although they may eliminate wastes through their terminal pores. Their tentacles, when present, are smaller than those of gastrozooids and lack nematocyst batteries. Bracts, which are highly gelatinous because of the enlarged mesogloea, serve for protection and buoyancy. Gastrozooids, or siphons, are feeding polyps that retain a mouth and a tentacle with lateral contractile branches (the tentilla), each of which has a nematocyst battery — a complicated coiled terminal knob equipped with numerous nematocysts. The foot-pedicle of the gastrozoid where it joins with the stem of the colony may also give rise to new gastrozooids, palpons, and bracts.

The medusoid derivatives comprise the sexual gonophores and the asexual nectophores. They usually retain the medusoid canal system. The foot-pedicle of the secondary polypoids of the siphosome give rise to gonophores, which have a manubrium bearing the gonads but which usually lack tentacles. Nectophores or swimming bells are typically budded from the nectosome. These are the individuals concerned with floatation and locomotion of the colony and they have no mouth, manubrium, gonads, tentacles or marginal sense organs, though they have well-developed surrounding muscles and nerves. Several associated structures of the nectophores are important for the classification of some siphonophores, for instance, the nectosac (the subumbrella cavity of a medusoid), the ostium (the velar end of a nectophore), the hydroecium (the cavity on the ventral side of the nectophores for housing the retracted stem with its associated structures), and the somatocyst (a caecal part of the common gastric cavity in nectophores).

The Siphonophora, exclusively marine and pelagic, are subdivided into three suborders based on the presence or absence of the float and nectophores: the Cystonectae (with a large float and without nectophores), the Physonectae (with a small float and a long chain of nectophores), and the Calycophorae (with nectophores and without float). A key to the genera of this order is omitted because of the complex morphological changes in their life history.

Suborder Cystonectae

(sīs-tō-nēk-tē: swimming bladder)

Siphonophora with a large float; with only one budding zone (siphosomal) on one side of the float base; no bracts.

FAMILY PHYSALIIDAE

(fī-sāl-ē-ī-dē: bladder)

Cystonectae without stem; secondary buds forming cormidial groups, each consisting of secondary polyps, including gastrozooids and palpons, and gonodendra carrying nectophores; simple tentacles without branches; new gastrozooids and gonodendra budding off from the base of their predecessors; palpons without tentacles formed by a gradual change of gastrozooids; gonodendra with three types of medusoid individuals: the reduced male and female gonophores, the peculiar asexual nectophores, and the jelly-polyps (probably vestigial nectophores); all gonophores of a whole animal of the same sex; horizontal float comparatively small in the young but enormously enlarged in the older stages.

Genus *Physalia* Lamarck 1801
With the characters of the family.

(fī-sāl-ya: bladder)

Physalia physalis Linnaeus 1758 (Plate 11a)

(fī-sāl-īs: bladder)

Horizontal length of whole animal up to 300 mm or more; the only known species of the genus.

Occurrence: Bay of Fundy.

Suborder Physonectae

(fī-sō-nēk-tē: swimming bellows)

Siphonophora with a small float; one budding zone on either side of float base: from one zone, the nectosome, budding off nectophores that propel the whole animal, and from the other, the siphosome, budding off gastrozooids, palpons, bracts, and gonophores.

FAMILY AGALMIDAE

(a-gāl-mī-dē: honour)

Physonectae with a long series of nectophores arranged in 2 rows on either side of nectosome.

Genus *Agalma* Eschscholtz 1825

(a-gāl-ma: honour)

Agalmidae with tentilla (lateral branches of tentacle) with 3 terminal appendages: a terminal ampulla and a pair of lateral horns.

Agalma elegans (M. Sars 1846) (Plate 11b)

(ēl-ē-gaŋs: elegant)

Nectophore up to 8 mm in length; with produced lateral wings that appear to be triangular in lateral view because of the presence of a vertical ridge; nectosac triangular from dorso-ventral view.

Occurrence: Bay of Fundy.

Genus *Nanomia* A. Agassiz 1865

(nā-nōm-ē-a: dwarf)

Agalmidae with tentilla threadlike; gonodendra in pairs at bases of a series of palpons, sexes alternating from side to side.

Nanomia cara A. Agassiz 1865 (Plate 11c)

(kār-a: head)

Nectophore up to 5 mm long; with small truncated wings; nectosac Y-shaped from dorso-ventral view.

Occurrence: Bay of Fundy; Gulf of St. Lawrence.

Order Siphonophora

FAMILY PHYSOPHORIDAE

(fī-sō-for-ī-dē: bellows bearer)

Physonectae with siphosomal budding zone expanding into a spiral sac that buds off the cormidial groups on the outer rim of the underside; the single palpons of each cormidial group proportionately very large; a male and female gonodendron budding alongside each other in a whorl between the palpons and the gastrozooids.

Genus *Physophora* Forskål 1775

(fī-sōf-er-a: bellows bearer)

With the characters of the family.

Physophora sp.

The species identity was not given in the original record (Brunel 1961 in Shih 1971). It is very likely that it belongs to *Physophora hydrostatica* Forskål 1775 (hī-drō-stāt-ik-a: standing in water) (Plate 11d), the only known species of this genus. The nectophore of this species has a nectosac characterized by sub-angular expansions on the oral side and deep emargination of the aboral side.

Occurrence: Gulf of St. Lawrence.

Suborder Calyphorae

(kāl-ī-kō-for-ē: calyx bearer)

Siphonophora without float; with nectophores and bracts (except in the Hippopodiidae); usually with three growth phases: a larval phase comprising the whole oozoid with its precocious nectophore, a polygastric phase consisting of a nectosome and siphosome with attached groups of gastrozooids, bracts (when present), and buds of gonophores, and a eudoxid phase formed by detached terminal stem-group of polygastric stage, carrying mature gonophores, living free in plankton. The gonophores are set free in the Hippopodiidae, which lack eudoxids.

The diagnoses of genera and species that follow are based on the nectophores of the polygastric phase, which are most commonly found in plankton samples, and provide distinct characters for identification.

FAMILY HIPPOPODIIDAE

(hīp-ō-pōd-ē-ī-dē: horseshoe)

Calyphorae with a succession of up to 12 or more nectophores at once; stem retracted up amongst nectophores; spines or protuberances on nectophores, more prominent in young stages and less conspicuous in later stages; no eudoxids.

Genus *Hippopodius* Quoy and Gaimard 1827

(hīp-ō-pōd-ē-ūs: horseshoe)

With the characters of the family.

Hippopodius hippopus (Forskål 1776) (Plate 12a)

(hīp-ō-pūs: horse-footed)

Nectophore up to 19 mm wide; horseshoe-shaped; 4 rounded dorsal knobs, varying in size and forming an arc above the ostium; radial ventral canal with a dilation that is large in newly formed nectophores and smaller or invisible in older ones.

Occurrence: Atlantic coast of Nova Scotia.

FAMILY DIPHYIDAE

(dī-fī-ī-dē: double growth)

Calyphorae usually with 2 rather similar nectophores in polygastric phase, one placed behind the other; posterior nectophore sometimes reduced or suppressed.

Class Hydrozoa

Genus ***Dimophyes*** Moser 1925 (dī-mo-fī-ēz: two forms)
Diphyidae with anterior nectophore with undivided mouth plate; posterior nectophore reduced and obsolescent, half enclosed in hydroecium, with truncated articulating surface.

Dimophyes arctica (Chun 1897) (Plate 12b) (ark-tīk-a: arctic)
The only species of this genus; anterior nectophore up to at least 13 mm long.
Occurrence: Atlantic coast of Nova Scotia.

Genus ***Diphyes*** Cuvier 1817 (dī-fī-ēz: double growth)
Diphyidae with anterior nectophore 5-ridged, with 3 large teeth around the ostium, an undivided mouth plate with slightly prominent baso-lateral angles, deep hydroecium.

Diphyes dispar Chamisso and Eysenhardt 1821 (Plate 12c) (dīs-par: unequal)
Anterior nectophore up to 35 mm long; hydroecium extending for about half the length of nectophore; somatocyst narrow and subcylindrical; nectosac wide and subcylindrical for most of its length, suddenly occluded near apex.
Occurrence: Atlantic coast of Newfoundland.

Genus ***Lensia*** Totton 1932 (lēn-sē-a: lens)
Diphyidae with anterior nectophore with divided mouth plate; posterior nectophore, where known, truncated proximally, with a rounded mouth plate and no conspicuous teeth.

Lensia conoidea (Kefferstein and Ehlers 1860) (Plate 12d) (kō-noid-ē-a: cone-shaped)
Anterior nectophore up to 20 mm long; 5 longitudinal crested ridges; base of lateral ridge straight; somatocyst about one-half the length of nectophore, base of somatocyst below ostium.
Occurrence: Bay of Fundy.

Plate 1

Order Anthomedusae

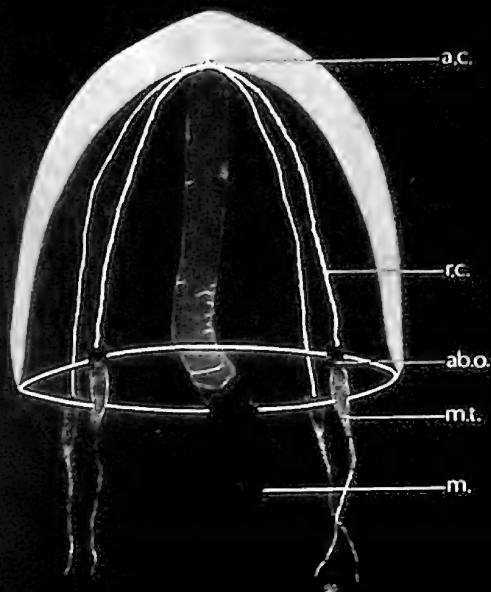
FAMILY CORYNIDAE

- a. *Sarsia princeps* (Haeckel 1879); p. 30
Height: 10.5 mm.
Mouth simple and tubular.
4 solid marginal tentacles with abaxial ocelli.
Radial canals with rugged edges.
With an apical canal.
- b. *Sarsia tubulosa* (M. Sars 1835); p. 30
Height: 12.7 mm. Modified from Mayer 1910.
Mouth simple and tubular.
4 solid marginal tentacles with abaxial ocelli.
Radial canals smooth.
With a globular apical chamber.

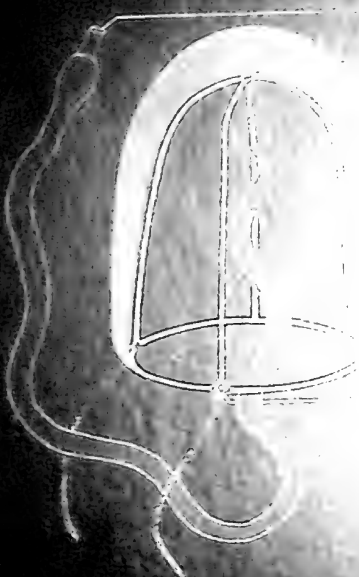
FAMILY TUBULARIIDAE

- c. *Hybocodon pendulus* (L. Agassiz 1862); p. 31
Height: 2.3 mm. Modified from Mayer 1910.
Mouth simple and tubular.
Marginal tentacular bulbs without ocelli.
One marginal tentacular bulb bearing tentacle, 2 other bulbs with beadlike tentacles.
- d. *Hybocodon prolifer* L. Agassiz 1862; p. 31
Height: 0.7 mm.
Mouth simple and tubular.
Marginal tentacles without ocelli.
Marginal tentacular bulbs with one or more beadlike tentacles and medusa buds.

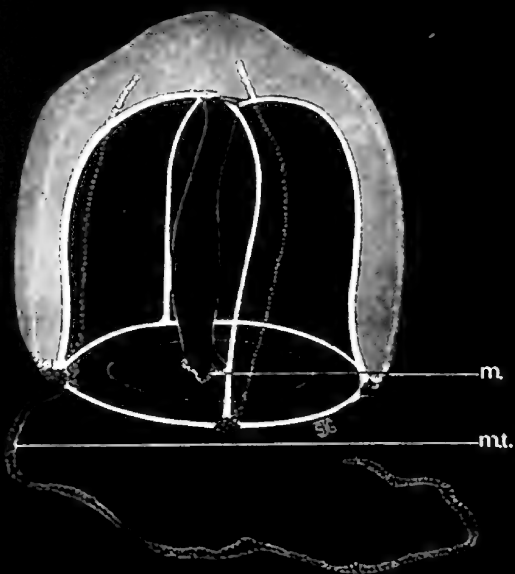
a.c.: apical canal; a.ch.: apical chamber; ab.o.: abaxial ocellus; m.: mouth;
m.b.: medusa bud; m.t.: marginal tentacle; r.c.: radial canal.



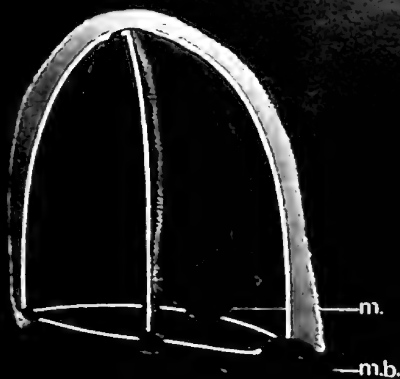
a



b



c



d

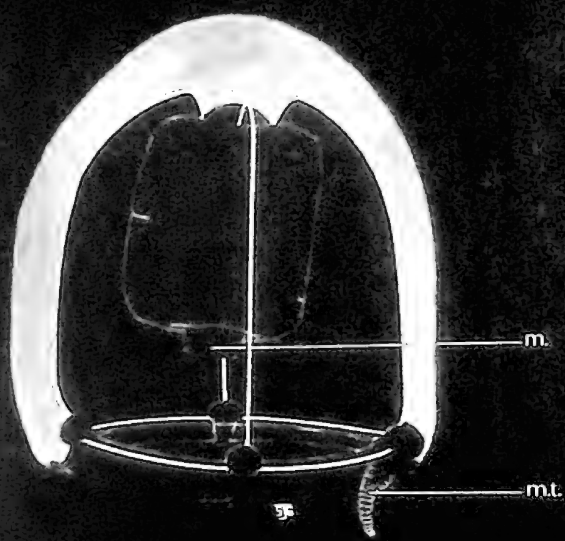
Plate 2

Order Anthomedusae

FAMILY TUBULARIIDAE

- a. *Euphysa aurata* Forbes 1848; p. 30
Height: 1.4 mm.
Mouth simple and tubular.
Only one marginal tentacle.
- b. *Euphysa flammea* (Linko 1905); p. 30
Height: 3.5 mm.
Mouth simple and tubular.
4 marginal tentacles developed in succession.
- c. *Euphysa tentaculata* Linko 1905; p. 30
Height: 4.7 mm.
Mouth simple and tubular.
3 marginal tentacles, one long and 2 short.
- d. *Plotocnide borealis* Wagner 1885; p. 31
Height: 0.8 mm.
Mouth simple and tubular.
4 equally developed marginal tentacles, each with a terminal knob of nematocysts.

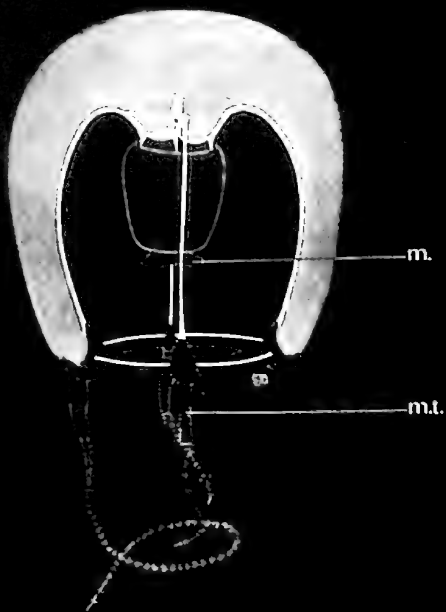
m.: mouth; m.t.: marginal tentacle; t.k.: terminal knob.



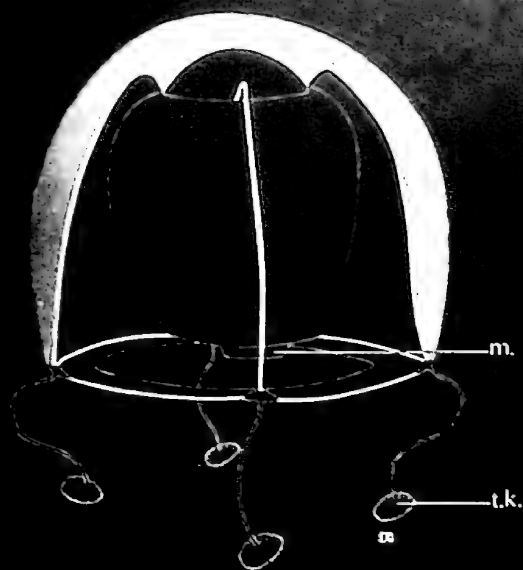
a



b



c



d

Plate 3

Order Anthomedusae

FAMILY HYDRACTINIIDAE

- a. *Podocoryne borealis* (Mayer 1910); p. 31
Height: 3 mm.
Mouth with 4 oral lips that branch 1–2 times, with a terminal knob of nematocysts on each branch.
16–32 solitary marginal tentacles.
- b. *Podocoryne americana* Mayer 1910; p. 31
Diameter: 3.5 mm. Modified from Mayer 1910.
Mouth with 4 unbranched oral lips, each with one terminal cluster of nematocysts.
Up to 32 solid marginal tentacles.

FAMILY RATHKEIDAE

- c. *Rathkea octopunctata* (M. Sars 1835); p. 32
Height: 0.8 mm.
Mouth with 4 oral lips, each armed with 2 pairs of nematocyst knobs.
Gonads surrounding manubrium; medusa bud may be present.
4 clusters of marginal tentacles; each cluster with 3 to 5 tentacles.

FAMILY BOUGAINVILLIIDAE

- d. *Bougainvillia principis* (Steenstrup 1850); p. 32
Height: 4.5 mm. Modified from Russell 1953.
Mouth with 4 oral tentacles, each divided 5–6 times.
Manubrium without peduncle.
Gonads adradially on manubrium.
4 clusters of marginal tentacles; each cluster with 30–40 tentacles of the same kind.
- e. *Bougainvillia superciliaris* (L. Agassiz 1849); p. 32
Height: 3.7 mm.
Mouth with 4 oral tentacles, each divided 4–5 times.
Manubrium with peduncle.
Gonads interradially on manubrium.
4 clusters of marginal tentacles; each cluster with 11–15 tentacles of the same kind.
- f. *Nemopsis bachei* L. Agassiz 1849; p. 32
Height: 4.6 mm.
Mouth with 4 oral tentacles, each divided 5–7 times.
Gonads on radial lobes of manubrium extending along radial canals.
4 clusters of marginal tentacles; each cluster with 14–18 tentacles belonging to 2 types: a median pair with terminal knob, and 6–8 lateral pairs of simple threadlike tentacles.

g.: gonad; m.b.: medusa bud; m.t.: marginal tentacle; o.l.: oral lip; o.t.: oral tentacle.

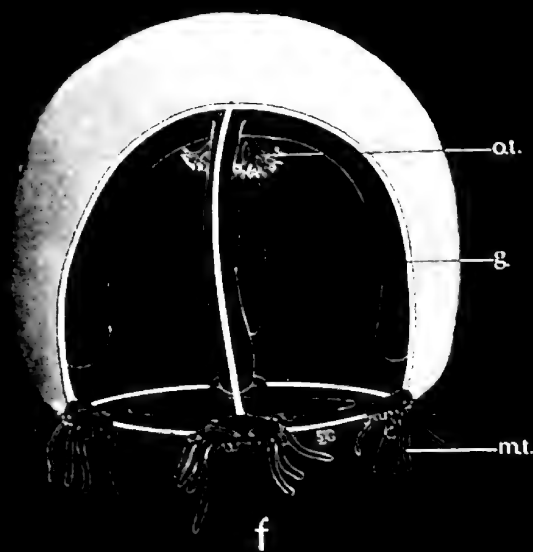
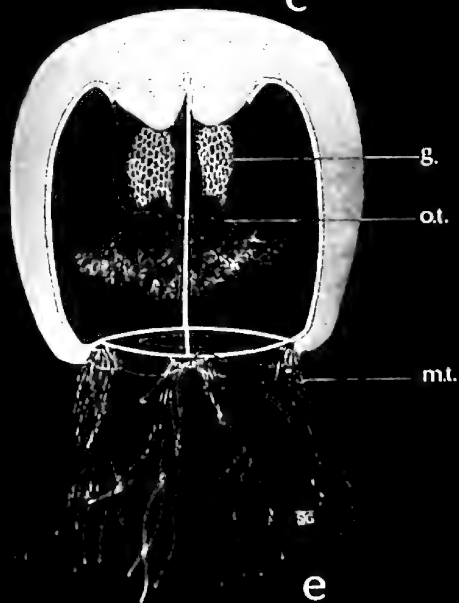
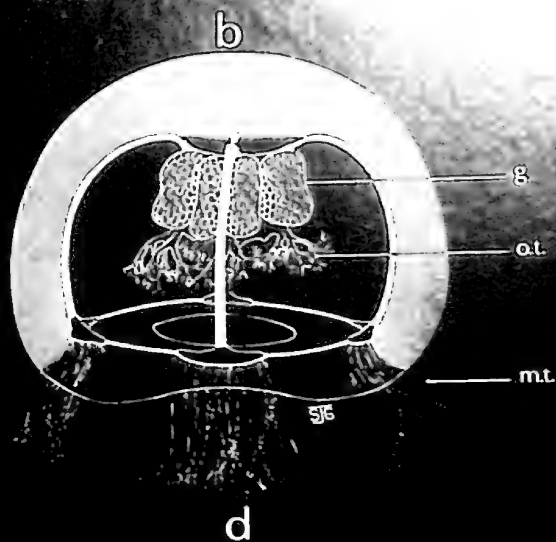
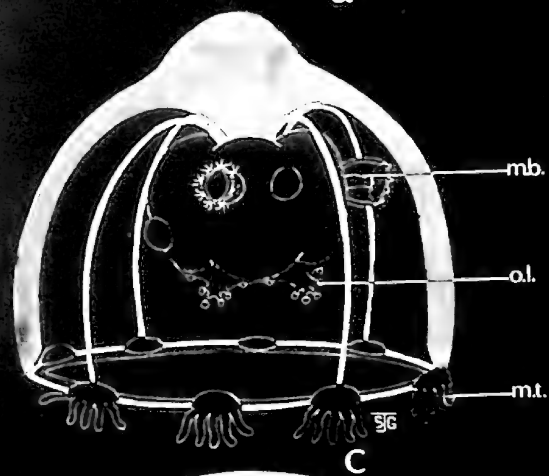
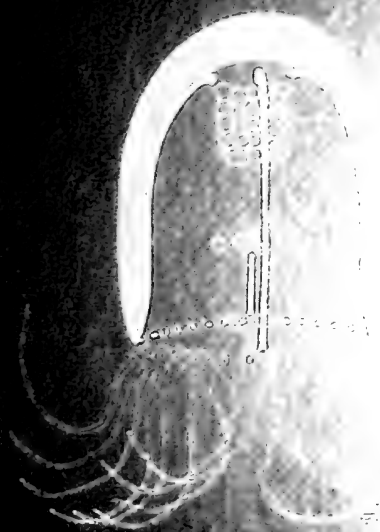
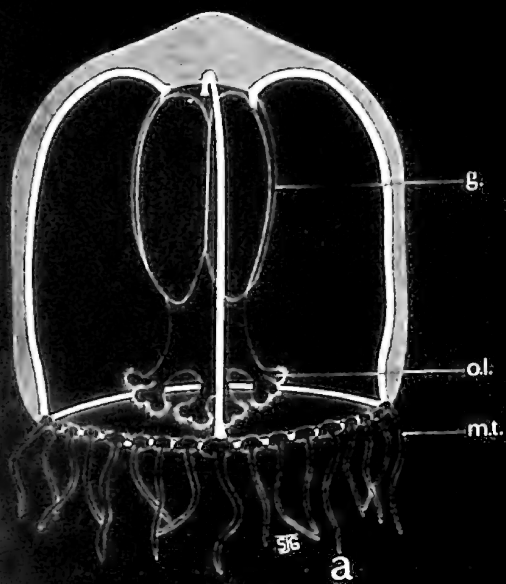


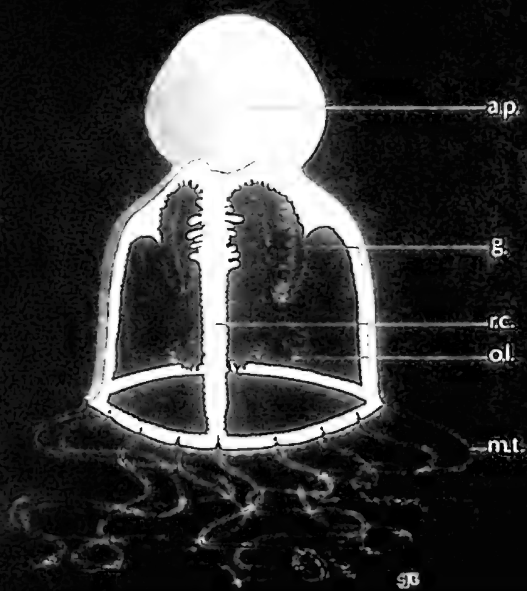
Plate 4

Order Anthomedusae

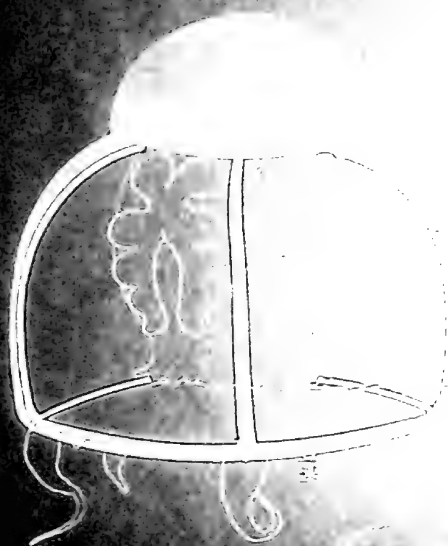
FAMILY PANDEIDAE

- a. ***Catablema vesicarium*** (A. Agassiz 1862); p. 33
Height: 7.3 mm.
Umbrella with a spherical apical projection.
Mouth with 4 large crenulated oral lips.
Gonads folded, on manubrium.
Radial canals broad and heavily denticulated.
- b. ***Halitholus cirratus*** Hartlaub 1913; p. 33
Height: 13 mm. Modified from Bigelow 1920.
Umbrella with globular apical projection.
Mouth with 4 faintly crenulated oral lips.
Gonads horsehose-shaped, on manubrium.
Radial canals smooth or slightly jagged.
Marginal tentacles about 40.
- c. ***Halitholus pauper*** Hartlaub 1913; p. 33
Height 2.2 mm.
Umbrella with low rounded apical projection.
Mouth with 4 faintly crenulated oral lips.
Gonads horseshoe-shaped, on manubrium.
Radial canals smooth.
4 large perradial and 4 small interradian marginal tentacles.

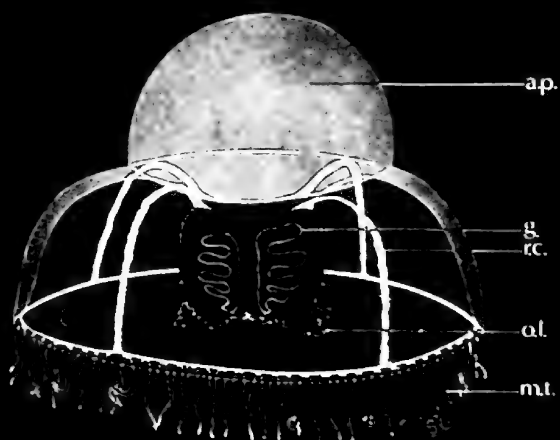
a.p.: apical projection; g.: gonad; m.t.: marginal tentacle; o.l.: oral lip; r.c.: radial canal.



a



c



b

Plate 5

Order Anthomedusae

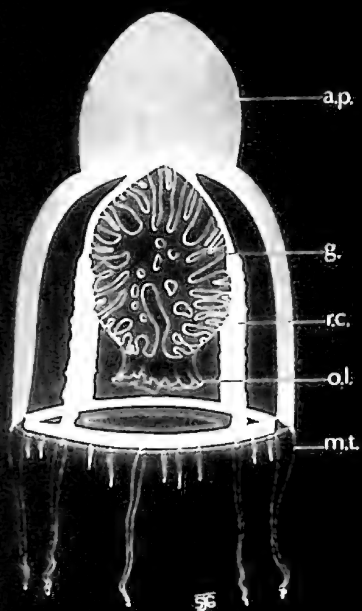
FAMILY PANDEIDAE

- a. *Leuckartiara nobilis* Hartlaub 1913; p. 33
Height: 20 mm. Modified from Russell 1953.
Umbrella with Gothic-arched apical projection.
Mouth with 4 crenulated oral lips.
Gonads horseshoe-shaped with folds directed perradially.
Radial canals broad with short lateral diverticula.
24–40 marginal tentacles of different sizes.
- b. *Leuckartiara octona* (Fleming 1823); p. 34
Height: 5.0 mm.
Umbrella with Gothic-arched apical projection.
Mouth with 4 crenulated oral lips.
Gonads horseshoe-shaped with folds directed perradially.
Radial canals smooth or slightly jagged.
12–24 (usually 16) marginal tentacles and 16 or more club-shaped rudimentary marginal tentacles.
- c. *Neoturris pileata* (Forskål 1775); p. 34
Height: 38 mm. Modified from Russell 1953.
Umbrella with Gothic-arched apical projection.
Mouth with 4 crenulated oral lips.
Gonads with horizontal folds directed interradially and isolated pits on interradiial surface.
Marginal tentacles numerous, usually 60–80.

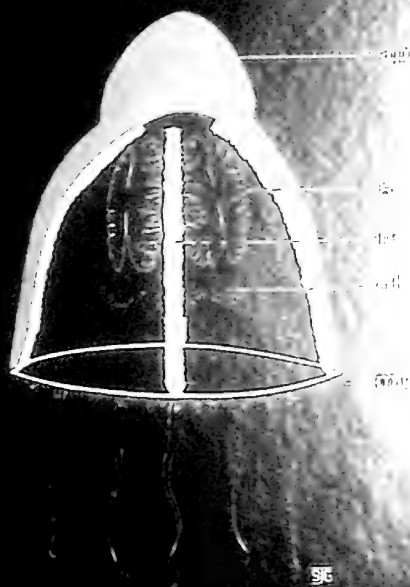
FAMILY CALYCOPSIDAE

- d. *Eumedusa birulai* (Linko 1913); p. 34
Height: 13 mm. Modified from Bigelow 1920.
Mouth with 4 simple oral lips.
4 centripetal canals.
Marginal tentacles of 2 types, with and without terminal knob.

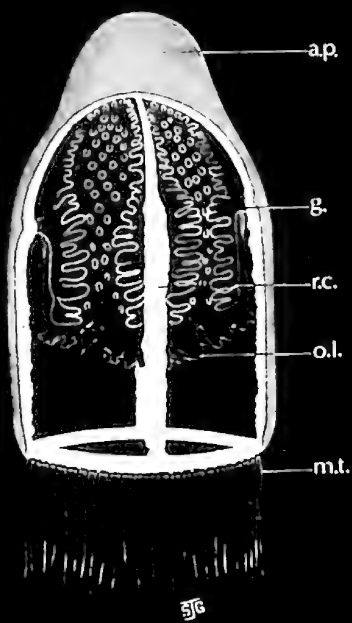
a.p.: apical projection; c.c.: centripetal canal; g.: gonad; m.t.: marginal tentacle; o.l.: oral lip; r.c.: radial canal.



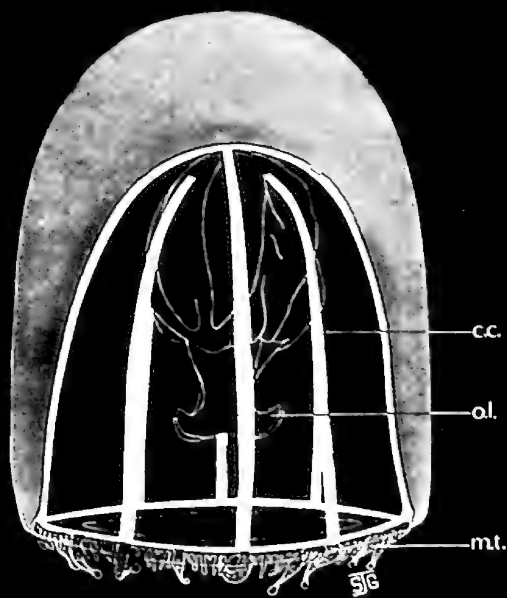
a



b



c



d

Plate 6

Order Leptomedusae

FAMILY DIPLEUROSOMATIDAE

- a. *Dipleurosoma typicum* Boeck 1866; p. 36
Diameter: 5.6 mm.
Gonads on radial canals separated from manubrium.
5–18 radial canals.
More than 100 marginal tentacles.

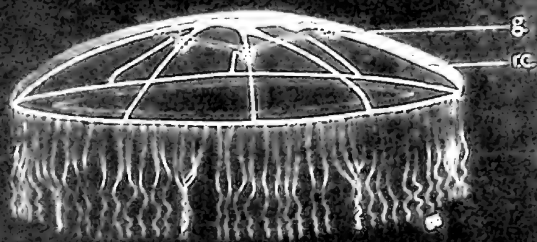
FAMILY MELICERTIDAE

- b. *Melicertum octocostatum* (M. Sars 1835); p. 36
Height: 5 mm.
Gonads on radial canals separated from manubrium.
8 radial canals.
Up to 72 large marginal tentacles alternating with same number of small tentacles.

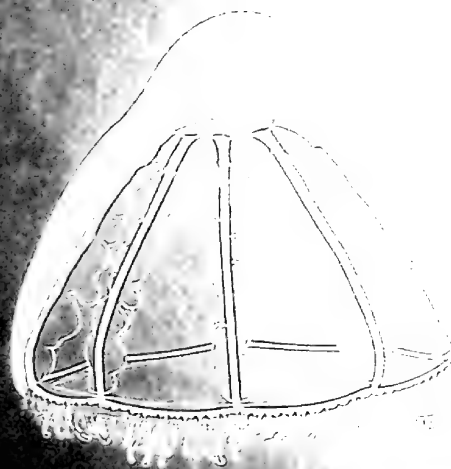
FAMILY LAODICEIDAE

- c. *Laodicea undulata* (Forbes and Goodsir 1853); p. 36
Height: 14.5 mm. Modified from Russell 1953.
Mouth with 4 crenulated oral lips.
Gonads on radial canals contiguous with manubrium.
4 simple radial canals.
Up to 600 marginal tentacles alternating with cordyli.
- d. *Ptychogena lactea* A. Agassiz 1865; p. 37
Height: 25 mm. Modified from Haeckel 1881.
Gonads on radial canals contiguous with manubrium.
4 radial canals with lateral diverticula.
Up to 300 marginal tentacles alternating with club-shaped cordyli.
- e. *Staurophora mertensi* Brandt 1838; p. 37
Diameter: 25.6 mm.
Cross-shaped manubrium.
4 simple radial canals.
Up to 4,400 marginal tentacles alternating with cordyli.

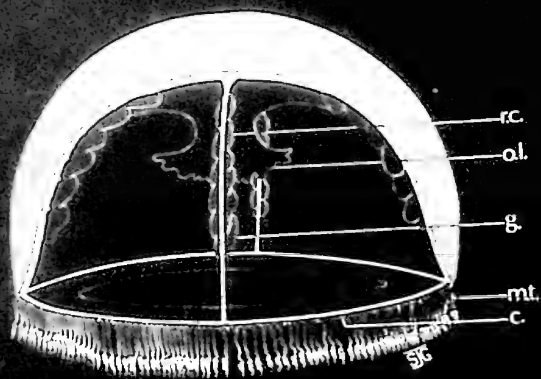
c.: cordylus; g.: gonad; m.t.: marginal tentacle; mn.b.: manubrium; o.l.: oral lip; r.c.: radial canal.



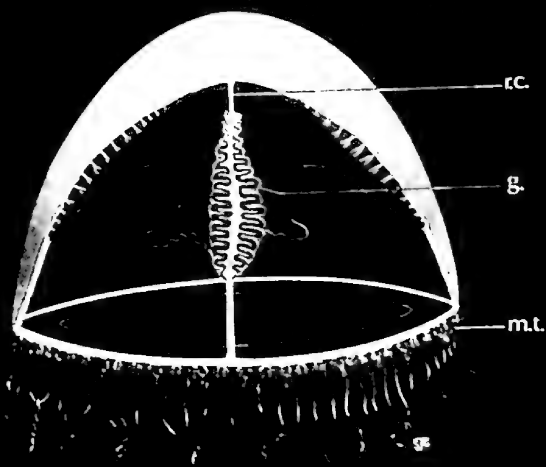
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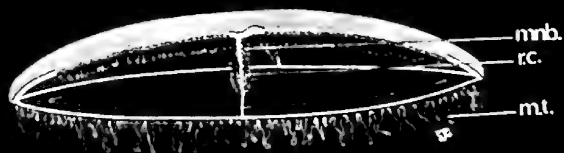
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e

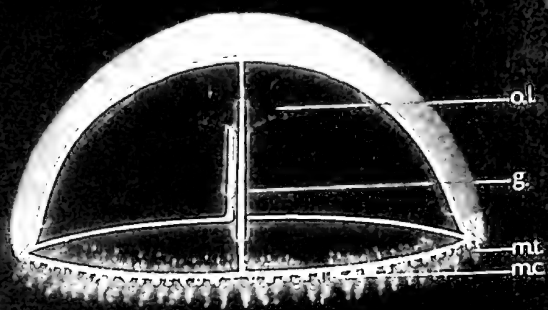
Plate 7

Order Leptomedusae

FAMILY MITROCOMIDAE

- a. ***Cosmetira pilosella*** Forbes 1848; p. 37
Height: 11.5 mm. Modified from Russell 1953.
Manubrium with slightly folded oral lips.
Gonads on radial canals separated from manubrium.
64–100 marginal tentacles; 6–10 marginal cirri between successive tentacles, older cirri extending well up umbrella surface.
With marginal vesicles.
- b. ***Halopsis ocellata*** A. Agassiz 1863; p. 37
Diameter: 30 mm. Modified from Russell 1953.
Manubrium short and wide.
Gonads on radial canals separated from manubrium.
12–16 radial canals arranged in 4 groups.
Marginal tentacles up to 400, alternating with marginal cirri.
- c. ***Mitrocomella polydiademata*** (Romanes 1876); p. 38
Diameter: 17 mm.
Manubrium with simple oral lips.
36–64 marginal tentacles; 5–9 marginal cirri between successive tentacles.
- d. ***Tiaropsis multicirrata*** (M. Sars 1835); p. 38
Height: 5 mm. Modified from Russell 1953.
Manubrium with 4 folded oral lips and short broad peduncle.
Up to 300 marginal tentacles; without marginal cirri.

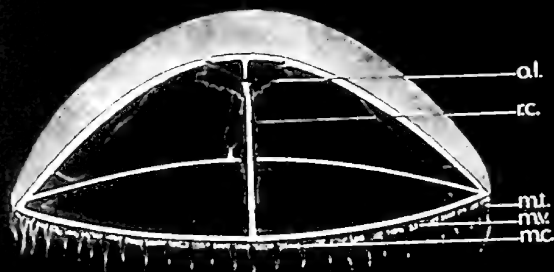
g.: gonad; m.c.: marginal cirrus; m.t.: marginal tentacle; m.v.: marginal vesicle; o.l.: oral lip; p.: peduncle; r.c.: radial canal.



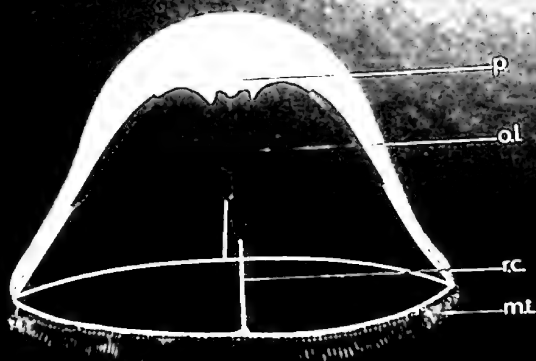
a



b



c



d

Plate 8

Order Leptomedusae

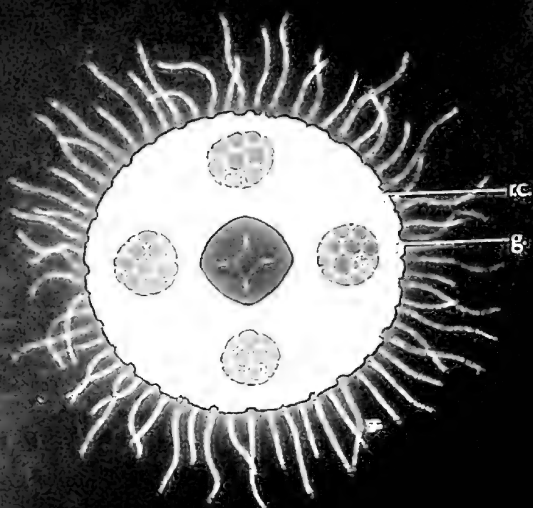
FAMILY CAMPANULARIIDAE

- a. *Obelia* sp.; p. 38
Diameter: 1 mm.
Umbrella with reduced velum.
Gonads on radial canals separated from manubrium.
4 radial canals.
8 marginal vesicles.
- b. *Phialidium bicophorum* (L. Agassiz 1862); p. 38
Diameter: 3.3 mm. Modified from Mayer 1910.
Umbrella with normal velum.
Gonads spindle-shaped in middle quarter of radial canals.
16 marginal tentacles alternating with marginal vesicles.
- c. *Phialidium folleatum* (McCrady 1857); p. 38
Diameter: 5 mm.
Umbrella with normal veium.
Gonads oval, on distal region of radial canals.
Marginal tentacles 16, rarely more, alternating with marginal vesicles.
- d. *Phialidium languidum* (A. Agassiz 1862); p. 39
Diameter: 8.8 mm.
Umbrella with normal velum.
Gonads linear along distal half of radial canals.
32 or more marginal tentacles, 2 marginal vesicles between successive tentacles.

FAMILY EUTIMIDAE

- e. *Tima formosa* L. Agassiz 1862; p. 39
Diameter: 64 mm.
Manubrium with thick and long peduncle.
Gonads on entire length of radial canals.
4 radial canals.
Umbrella with many marginal warts.

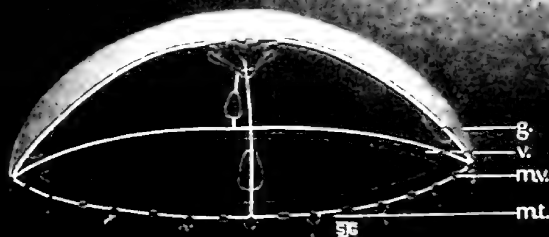
g.: gonad; m.t.: marginal tentacle; m.v.: marginal vesicle; m.w.: marginal wart; p.: peduncle; r.c.: radial canal; v.: velum.



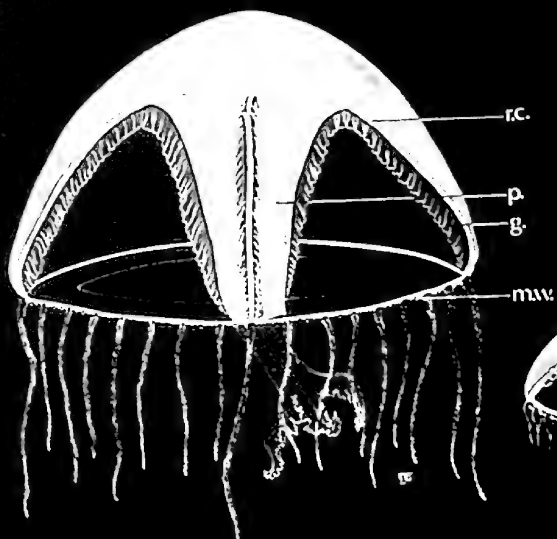
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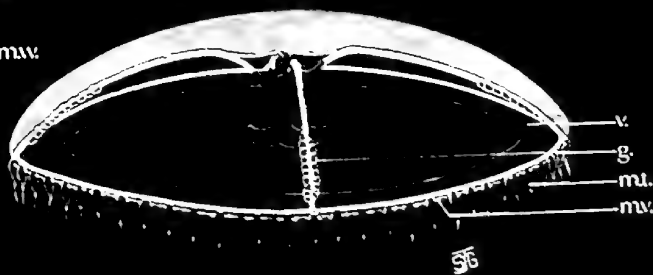
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e



d

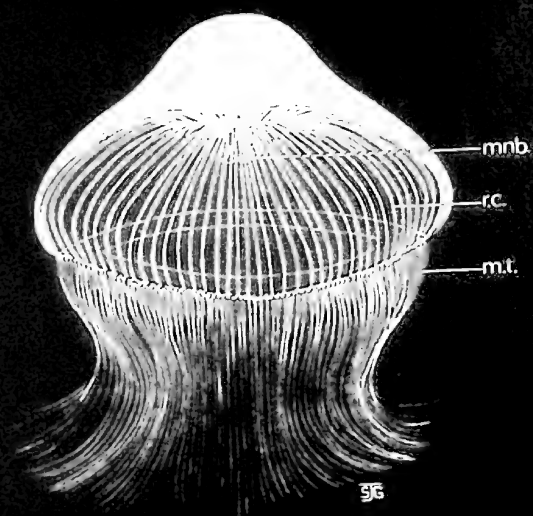
Plate 9

Order Leptomedusae

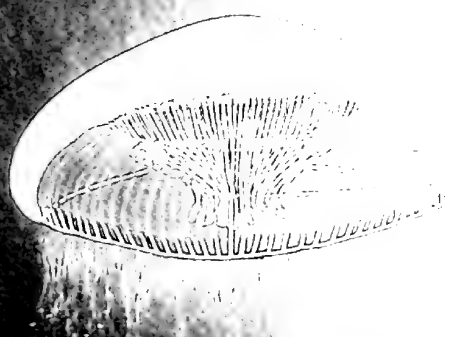
FAMILY AEQUOREIDAE

- a. ***Aequorea albida*** A. Agassiz 1862; p. 39
Diameter: 60 mm. Modified from A. Agassiz 1865.
Manubrium not extending below umbrella margin.
80–100 radial canals.
Marginal tentacles 2–3 times the number of radial canals.
2–3 marginal bulbs between successive marginal tentacles.
 - b. ***Aequorea vitrina*** Gosse 1853; p. 39
Diameter: 69 mm.
Manubrium not extending below umbrella margin.
60–100 radial canals.
Marginal tentacles more than 3 times the number of radial canals.
Few marginal bulbs.
 - c. ***Rhacostoma atlanticum*** L. Agassiz 1850; p. 40
Diameter: 115 mm. Modified from Mayer 1910.
Manubrium extending below umbrella margin.
80–100 radial canals.
Marginal tentacles slightly more than the number of radial canals.
Subumbrella with radial rows of gelatinous papillae.
-

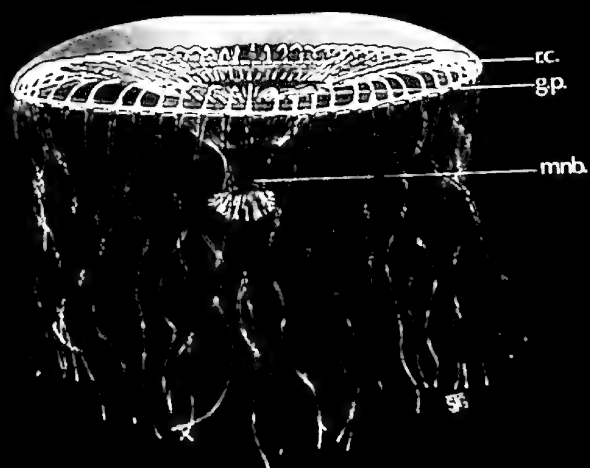
g.p.: gelatinous papilla; m.t.: marginal tentacle; mnb.: manubrium; r.c.: radial canal.



a



b



c

Plate 10

Order Trachymedusae

FAMILY PTYCHOGASTRIIDAE

- a. *Ptychogastria polaris* Allman 1878; p. 40
Diameter: 19 mm.
Exumbrella with 16 radiating ridges.
Mouth with 4 oral lips.
8 radial canals alternating with centripetal canals.
Marginal tentacles grouped in clusters, each cluster with 2 kinds of tentacles: 3 solid and threadlike, and numerous others with adhesive discs (inset showing enlargement of 2 clusters and the cut ends of tentacles).

FAMILY HALICREATIDAE

- b. *Halicreas minimum* Fewkes 1882; p. 41
Diameter: 30 mm. Modified from Bigelow 1905 and Vanhöffen 1902.
Umbrella with a conical apical projection; exumbrella with periradial gelatinous papillae.
Circular mouth without oral lips.
All marginal tentacles alike, each with a soft, flexible proximal part and a stiff, spine-like distal part.

FAMILY RHOPALONEMATIDAE

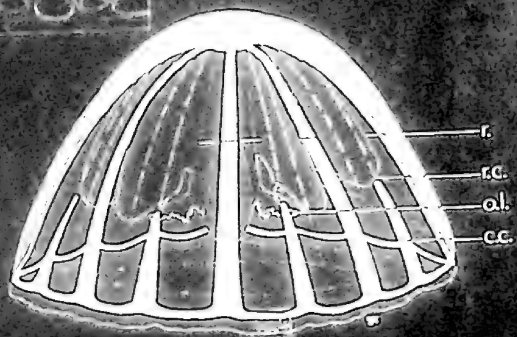
- c. *Aglantha digitale* (O.F. Müller 1776); p. 41
Height: 14.5 mm.
Umbrella high bell-shaped.
8 gonads pouch-like, hanging from radial canals close to peduncle.
80 or more marginal tentacles.

Order Narcomedusae

FAMILY AEGINIDAE

- d. *Aeginopsis laurentii* Brandt 1838; p. 41
Diameter: 8.8 mm.
16 gastric pouches.
8 peronia.
4 marginal tentacles coming off umbrella some distance above margin.

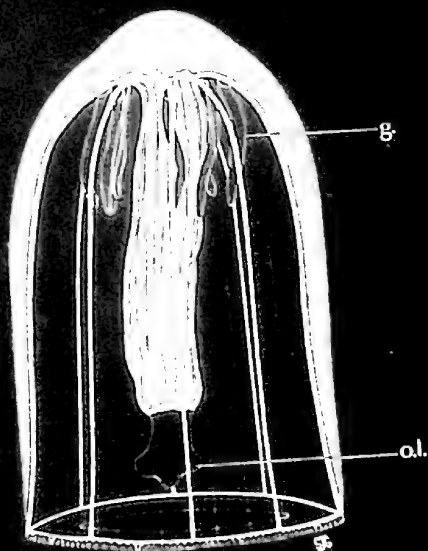
a.p.: apical projection; c.c.: centripetal canal; g.: gonad; g.p.: gelatinous papilla; ga.p.: gastric pouch; m.: mouth; m.t.: marginal tentacle; o.l.: oral lip; p.: peronium; r.: ridge; r.c.: radial canal.



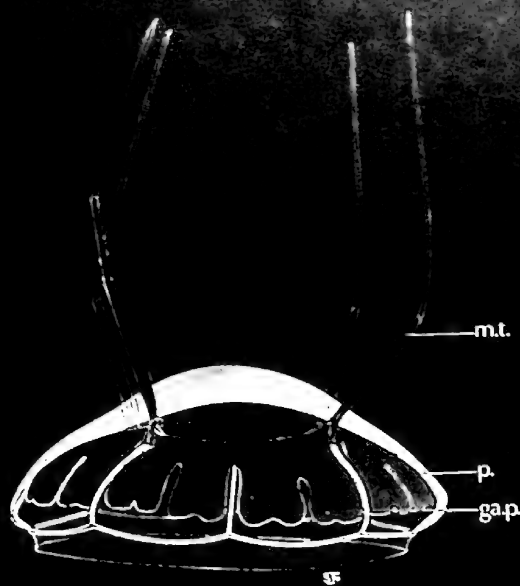
a



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c



d

Plate 11

Order Siphonophora

FAMILY PHYSALIIDAE

- a. *Physalia physalis* (Linnaeus 1758); p. 44
Whole animal; length of float: 30 mm.
Each cormidial group consisting of gastrozooids, palpons, and gonodendra.

FAMILY AGALMIDAE

- b. *Agalma elegans* (M. Sars 1846); p. 44
Nectophore, upper view; width: 80 mm. Modified from Bigelow and Sears 1935.
Lateral wings produced.
Nectosac triangular.
- c. *Nanomia cara* A. Agassiz 1865; p. 44
Nectophore, upper view; width: 5.3 mm. Modified from Totton 1953.
Lateral wings small, truncated.
Nectosac Y-shaped.

FAMILY PHYSOPHORIDAE

- d. *Physophora hydrostatica* Forskål 1775; p. 45
Nectophore, upper view; width: 20 mm. Modified from Totton 1965.
Nectosac T-shaped.

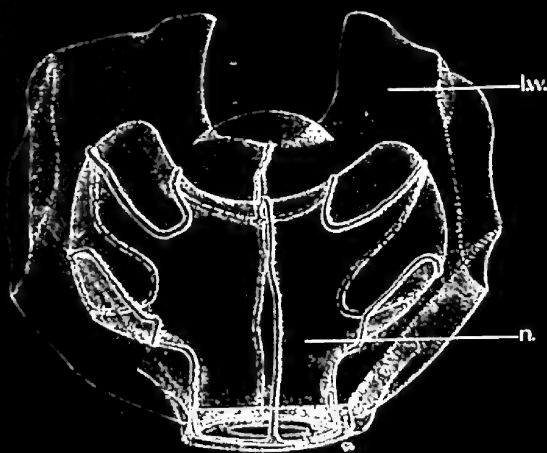
f.:float; l.w.: lateral wing; n.:nectosac.



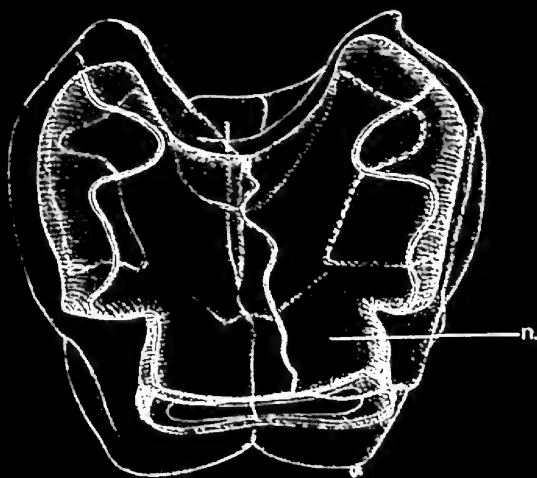
a



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d

Plate 12

Order Siphonophora

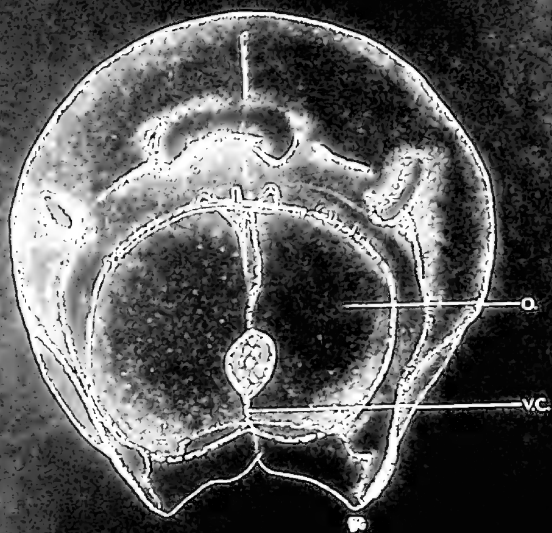
FAMILY HIPPOPODIIDAE

- a. *Hippopodius hippopus* (Forskål 1776); p. 45
Nectophore, upper view; width: 12.5 mm.
4 rounded dorsal knobs above ostium. Nectophore horseshoe-shaped.
Ventral canal with a dilation.

FAMILY DIPHYIDAE

- b. *Dimophyes arctica* (Chun 1897); p. 46
Anterior nectophore of polygastric phase, lateral view; length: 8 mm. Modified from Totton 1955.
Mouth plate undivided.
- c. *Diphyes dispar* Chamisso and Eysenhardt 1821; p. 46
Anterior nectophore of polygastric phase, lateral view; length: 20 mm. Modified from Kawamura 1915.
Hydroecium extending for about half the length of nectophore.
Nectosac wide, suddenly occluded near apex.
- d. *Lensia conoidea* (Kefferstein and Ehlers 1860); p. 46
Anterior nectophore of polygastric phase, lateral view; length: 14.5 mm. Modified from Bigelow and Sears 1937.
5 longitudinal ridges.
Base of somatocyst below ostium.

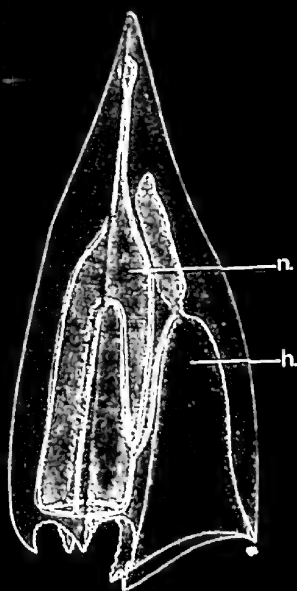
h.: hydroecium; m.p.: mouth plate; n.: nectosac; o.: ostium; s.: somatocyst;
v.c.: ventral canal.



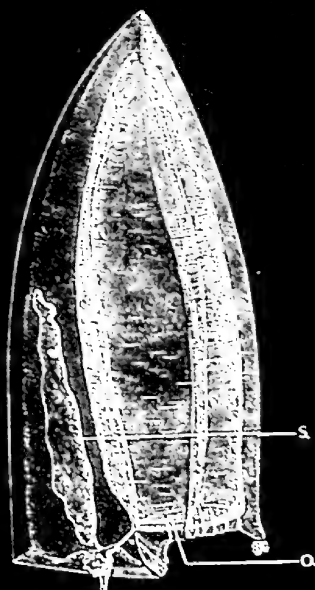
a



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d

Plate 13

Order Coronatae

FAMILY PERIPHYLLIDAE

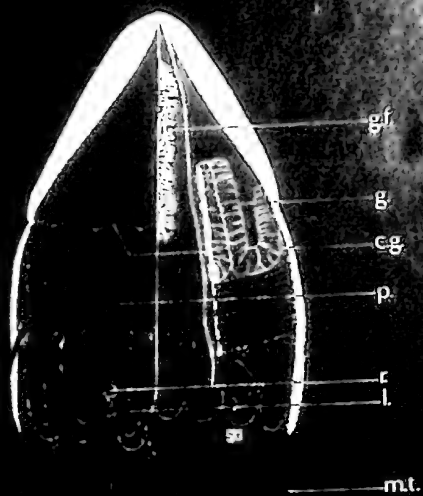
- a. *Periphylla periphylla* (Péron and Lesueur 1809); p. 79
Height: 53 mm. With one quadrant cut away to show gastric filaments, muscles and gonads.
Umbrella with coronal groove between central disc and peripheral pedalia.
Umbrella margin with 16 lappets.
12 marginal tentacles.

Order Semaestomeae

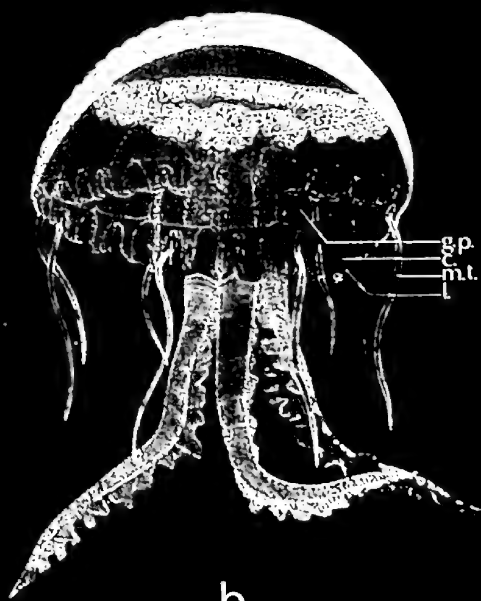
FAMILY PELAGIIDAE

- b. *Pelagia noctiluca* (Forskål 1775); p. 79
Diameter: 63 mm.
Stomach with 16 radiating gastric pouches; each pouch terminating in a pair of unbranched canals in corresponding lappet.
16 lappets.
8 marginal tentacles.

c.: canal from gastric pouch; c.g.: coronal groove; g.: gonad; g.f.: gastric filament; g.p.: gastric pouch; l.: lappet; m.t.: marginal tentacle; p.: pedali-um; r.: rhopalium.



a



b

Plate 14

Order Semaestomeae

FAMILY CYANEIDAE

a. *Cyanea capillata* (Linnaeus 1758); p. 80

Diameter: 260 mm.

Stomach giving rise to radiating gastric pouches; each pouch giving rise to many branching, blind canals in lappet.

Marginal tentacles in 8 clusters; each cluster arising from subumbrella at some distance from margin.

FAMILY ULMARIDAE

b. *Aurelia aurita* (Linnaeus 1758); p. 80

Diameter: 63 mm. With one quadrant cut away to show part of oral lips.

Stomach giving rise to radial canals.

Ring canal present.

Adradial canals unbranched; perradial and interradial canals with primary canal unbranched, but branches from their bases branched.

Marginal tentacles arising from umbrella slightly above margin.

c. *Aurelia limbata* (Brandt 1838); p. 80

Diameter: 90 mm. Modified from Kramp 1913.

Stomach giving rise to radial canals.

Ring canal present.

All radial canals, except adradial canals, branched.

Marginal tentacles arising from umbrella slightly above margin.

d. *Phacellophora camtschatica* Brandt 1838; p. 80

Diameter: 169 mm.

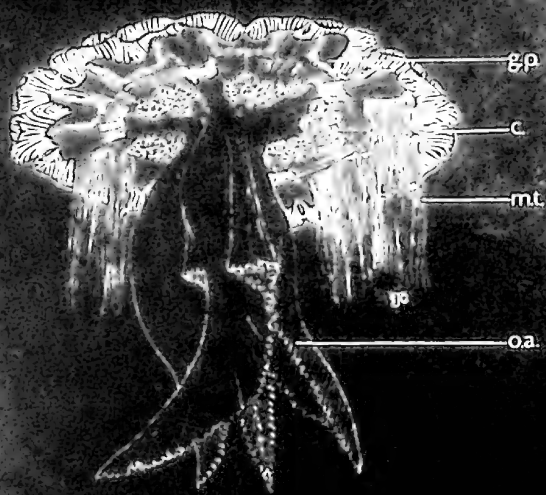
Stomach giving rise to radial canals.

Radial canals in rhopalar radii branched; in tentacular radii unbranched.

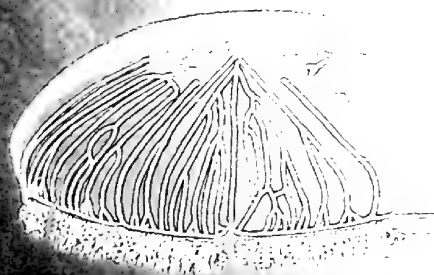
16 rhopalia alternating with 16 clusters of marginal tentacles.

Marginal tentacles arising from subumbrella.

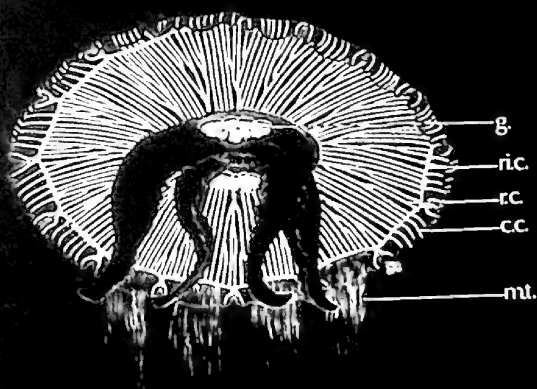
c.: canal from gastric pouch; c.c.: centrifugal canal; g.: gonad; g.p.: gastric pouch; m.t.: marginal tentacle; o.a.: oral arm; r.c.: radial canal (gastrovascular canal); ri.c.: ring canal.



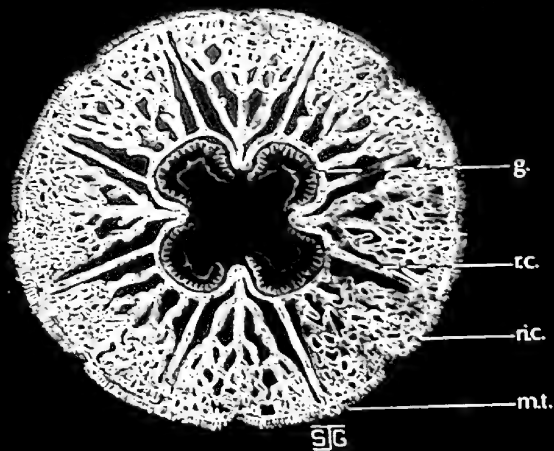
a



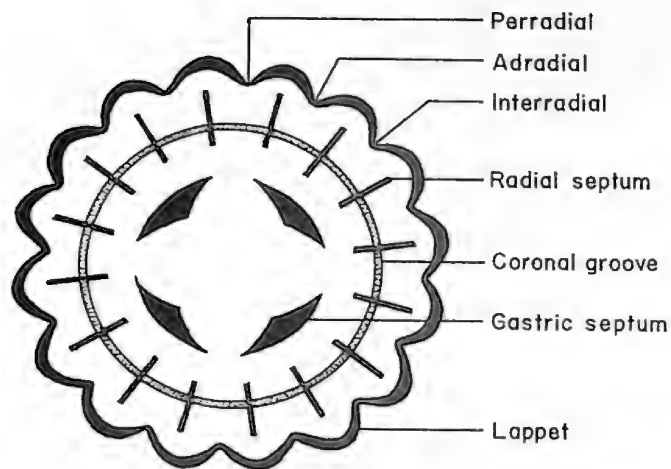
b



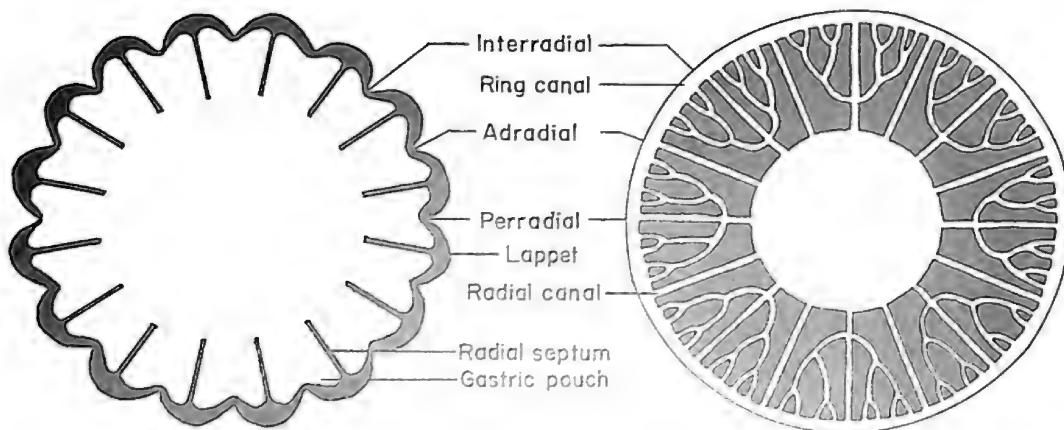
d



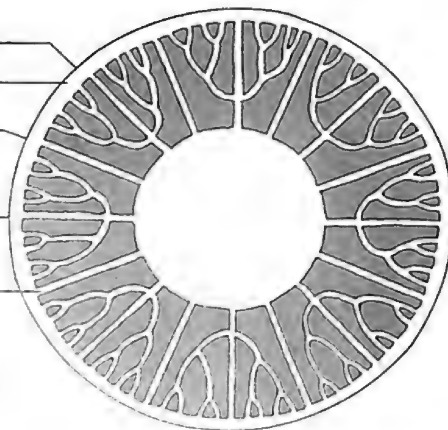
c



A



B



C

Figure 8

Diagrams to show general features and septa of Scyphozoa due to fusion of endodermal surfaces (black area) (after Russell 1970, with addition of coronal groove in "A" to show its approximate location viewed from the top):

A. Coronate

B. Semaestome with radial septa

C. Semaestome with canal system

Class Scyphozoa

The Scyphozoa (sīf-ō-zō-a: cup-shaped animal) in contrast to Hydrozoa, have amoebocytes in the mesogloea and gastric filaments in the gastrodermis. In their life cycle (Figure 8), medusae are more conspicuous, though shorter-lived than polyps. The medusae, usually dioecious, reproduce sexually. The fertilized egg develops into a planktonic larva, the planula, that settles on substrate and grows into a polyp, or scyphistoma. The scyphistoma gives rise to medusae by transverse fission and metamorphosis (strobilation). In *Pelagia*, the planula develops directly into ephyra and hence to medusa. The medusae (Figure 9) lack a velum and usually have the umbrella margin cleft into lappets where sensory organs are located. The umbrella is highly gelatinous and varies in shape in different orders. The manubrium extends distally into 4 elongated oral arms. There is no stomodaeum. The gastrovascular cavity expands to form 4 gastric pouches that, in some orders, are separated by 4 interradial septa. On their surfaces, facing the central gastrovascular cavity, the septa bear the gastric filaments of gastrodermal origin. The subumbrella surface is indented to the septa to form 4 pits, the subumbrella funnels or subgenital pits. In those orders lacking septa, there is a canal system similar to that of the Hydrozoa, but much more highly branched. Unlike the Hydrozoa, the gonads of the dioecious Scyphozoa are derived from, and located in, the gastrodermis. They are located on each side of each gastric septum, or in its absence, in the subumbrella wall surrounding the base of the gastrovascular cavity.

The Scyphozoa are exclusively marine and occur from the tropics to the Arctic and from surface to deep waters. The majority of scyphozoans are free-swimming at some stage of their life history but a few are entirely sessile, for example, Order Stauromedusae, which are excluded from further discussion.

Key to Orders of Scyphozoa

- 1a. Umbrella with coronal groove surrounding a central disc and with peripheral thickenings of jelly or pedalia; with solid marginal tentacles; mouth with simple oral lips Order Coronatae (p. 77)
- 1b. Umbrella without coronal groove and pedalia; marginal tentacles, if present, hollow; mouth with 4 simple oral arms with frilled or folded oral lips Order Semaestomeae (p. 79)

Order Coronatae

(kor-ōn-āt-ē: crown)

Scyphozoa with umbrella margin cleft into lappets; oral lips simple; sense organs (rhopalia) and solid marginal tentacles arising from clefts between lappets; a circular, coronal groove in exumbrella, and peripheral to this, a zone of gelatinous thickenings or pedalia divided by radiating clefts alternating in position with marginal tentacles and rhopalia; 4 interradial gastric septa; radial septa in gastrovascular sinus present.

FAMILY PERIPHYLLIDAE

(per-ī-fīl-ī-dē: leafy edge)

Coronatae with 4 interradial rhopalia; 4–28 marginal tentacles in groups of equal numbers between adjacent rhopalia.

Genus *Periphylla* Haeckel 1880

(per-ī-fīl-a: leafy edge)

Periphyllidae with 8 gonads; 12 marginal tentacles in 4 groups, each group with one perradial and 2 adradial; 16 lappets.

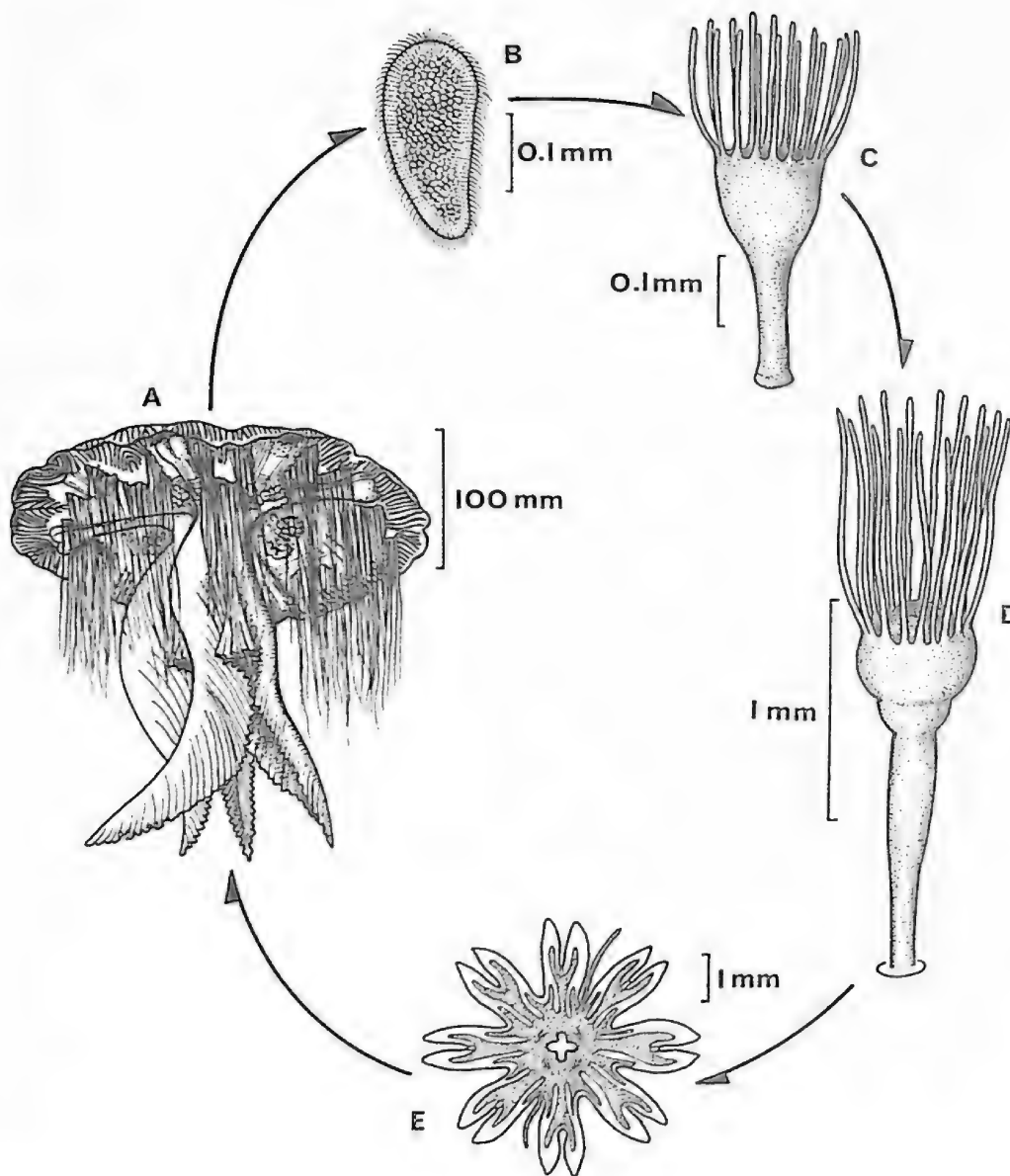


Figure 9
 Life cycle of a scyphozoan, *Cyanea capillata*
 (modified from Berrill 1949 and Hyman 1940):
 A. Mature medusa
 B. Planula
 C. Young scyphistoma
 D. Strobila
 E. Ephyra

Order Semaestomeae

Periphylla periphylla (Péron and Lesueur 1809) (Plate 13a) (per-ĩ-fĩl-a: leaf-edged)

Umbrella up to 200 mm wide, higher than wide, with a pointed or dome-shaped apex; gonads U-shaped; stomach and subumbrella purple or violet.
Occurrence: Gulf of St. Lawrence; Strait of Belle Isle.

Order Semaestomeae (sēm-ē-ō-stōm-ē-ē: having a mouth with marks on it)

Scyphozoa with umbrella margin cleft into lappets; mouth with 4 large curtain-like or gelatinous oral lips; hollow marginal tentacles present or absent; rhopalia present; no coronal groove and pedalia; no interradial gastric septa; with radial septa in gastrovascular sinus or with gastrovascular canal system.

Key to Genera of Semaestomeae

- 1a. Ring canal present; stomach giving rise to unbranched or branched radial canals 2
- 1b. Ring canal absent; stomach giving rise to gastric pouches separated by radial septa 3
- 2a. Invaginated gonads with subgenital pits; marginal tentacles arising from exumbrella slightly above umbrella margin
..... *Aurelia* Péron and Lesueur (p.80; Plates 14b, 14c)
- 2b. Protrusive sac-like gonads without subgenital pits; marginal tentacles arising from subumbrella *Phacellophora* Brandt (p. 80; Plate 14d)
- 3a. Each radiating gastric pouch terminating in a pair of unbranched canals entering the lappets; marginal tentacles arising from umbrella margin between clefts of lappets *Pelagia* Péron and Lesueur (p. 79; Plate 13b)
- 3b. Each radiating gastric pouch giving rise to numerous branching blind canals in lappets; marginal tentacles arising from subumbrella surface at a distance from umbrella margin *Cyanea* Péron and Lesueur (p. 79; Plate 14a)

FAMILY PELAGIIDAE (pel-āj-ē-ĩ-dē: living in the sea)

Semaestomeae with stomach giving rise to separated, unbranched radiating gastric pouches; no ring canal; marginal tentacles arising from umbrella margin between clefts of lappets.

Genus *Pelagia* Péron and Lesueur 1809 (pel-āj-ya: living in the sea)

Pelagiidae with exumbrella with numerous nematocyst warts; stomach with 16 similar gastric pouches, each terminating in a pair of unbranched canals entering lappets; 16 lappets; 8 marginal tentacles alternating with 8 rhopalia.

Pelagia noctiluca (Forskål) (Plate 13b) (nok-tĩ-lūk-a: shining by night)

The only species of the genus; umbrella up to 65 mm wide.

Occurrence: Atlantic coast of Nova Scotia.

FAMILY CYANEIDAE (sĩ-ăn-ē-i-dē: dark blue)

Semaestomeae with stomach giving rise to radiating gastric pouches; gastric pouches giving rise to many branching, blind canals in lappets; no ring canal; marginal tentacles arising from subumbrella at some distance from umbrella margin.

Genus *Cyanea* Péron and Lesueur 1809 (sĩ-ăn-ē-a: dark blue)

Cyaneidae with radial and circular muscles on subumbrella; 8 adradial clusters of marginal tentacles, each cluster containing several rows of tentacles.

Cyanea capillata (Linnaeus 1758) (Plate 14a) (kăp-îl-ăt-a: hairy)

Umbrella up to 1,000 mm wide; gastric pouches separated by radial septa; very few connections, or none, between canals arising from same gastric pouch; about 70 – 150 or more marginal tentacles in each group.

Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia, Newfoundland and Labrador; Gulf of St. Lawrence.

FAMILY ULMARIDAE (ŭl-mar-ĭ-dē: elm-like)

Semaeostomeae with or without subgenital pits; radial canals simple or branched; ring canal present.

Genus *Aurelia* Péron and Lesueur 1809 (or-ēl-ya: golden colour)

Ulmaridae with umbrella with 8 or 16 clefts; 4 unbranched oral arms; connections between a few or all the radial canals; small marginal tentacles and lappets arising from exumbrella slightly above umbrella margin; with subgenital pits.

Aurelia aurita (Linnaeus 1758) (Plate 14b) (or-ēt-a: with prominent ears)

Umbrella up to 400 mm wide; 8 broad lappets; adradial canals unbranched; per-radial and interradial canals with primary canal unbranched, but branches from their bases branch successively towards umbrella margin and with few connections between distal branches.

Occurrence: Bay of Fundy; Atlantic coast of Newfoundland; Gulf of St. Lawrence.

Aurelia limbata (Brandt 1838) (Plate 14c) (lĭm-bāt-a: fringed)

Umbrella up to 150 mm wide; 8 broad lappets; all canals except 8 adradial profusely branched, with numerous lateral diverticula, forming numerous connections between branches.

Occurrence: Bay of Fundy; Atlantic coast of Nova Scotia, Newfoundland and Labrador; Gulf of St. Lawrence.

Genus *Phacellophora* Brandt 1835 (fă-sēl-ō-for-a: bundle bearer)

Ulmaridae with umbrella with 8 or 16 clefts; 4 gonads; radial canals in rhopaliar radii branched, in tentacular radii simple; 16 rhopalia alternating with 16 clusters of marginal tentacles; marginal tentacles arising in linear clusters from subumbrella; no subgenital pits.

Phacellophora camtschatica Brandt 1838 (Plate 14d) (kăm-chat-ĭk-a: Camtschatican)

Umbrella up to 600 mm wide; 16 wide simple lappets; 5 – 8 blind-ending centrifugal canals arising from ring canal in each lappet; marginal tentacles in 16 clusters arising in a single row below ring canal.

Occurrence: Bay of Fundy.

List of Distribution

Species	A	B	C	D	E
<i>Aeginopsis laurentii</i>			x	x	x
<i>Aequorea albida</i>	x				
<i>Aequorea vitrina</i>					x
<i>Agalma elegans</i>	x				
<i>Aglantha digitale</i>	x	x	x	x	x
<i>Aurelia aurita</i>	x		x		x
<i>Aurelia limbata</i>	x	x	x	x	x
<i>Bougainvillia principis</i>				x	
<i>Bougainvillia superciliaris</i>	x	x	x	x	x
<i>Catablema vesicarium</i>	x	x	x	x	
<i>Cosmetira (pilosella?)</i>					x
<i>Cyanea capillata</i>	x	x	x	x	x
<i>Dimophyes arctica</i>		x			
<i>Diphyes dispar</i>			x		
<i>Dipleurosoma typicum</i>			x		
<i>Eumedusa birulai</i>			x		
<i>Euphysa aurata</i>	x	x			x
<i>Euphysa flammea</i>		x	x		
<i>Euphysa tentaculata</i>		x			x
<i>Halicreas minimum</i>		x			
<i>Halitholus cirratus</i>				x	
<i>Halitholus pauper</i>		x			
<i>Halopsis ocellata</i>	x				
<i>Hippopodius hippopus</i>		x			
<i>Hybocodon pendulus</i>	x	x			x
<i>Hybocodon prolifer</i>	x		x		
<i>Laodicea undulata</i>			x		
<i>Lensia conoidea</i>	x				
<i>Leuckartiara nobilis</i>			x		
<i>Leuckartiara octona</i>	x				x
<i>Melicertum octocostatum</i>	x		x		
<i>Mitrocomella polydiademata</i>	x	x			
<i>Nanomia cara</i>	x				x
<i>Nemopsis bachei</i>	x				

List of Distribution

Species	A	B	C	D	E
<i>Neoturris pileata</i>			x		
<i>Obelia</i> spp.	x	x	x		x
<i>Pelagia noctiluca</i>		x			
<i>Periphylla periphylla</i>					x
<i>Phacellophora camtschatica</i>	x				
<i>Phialidium bicophorum</i>	x				
<i>Phialidium folleatum</i>		x			
<i>Phialidium languidum</i>	x				
<i>Physalia physalis</i>	x				
<i>Physophora</i> (hydrostatica?)					x
<i>Plotocnide borealis</i>					x
<i>Podocoryne americana</i>	x				
<i>Podocoryne borealis</i>	x				
<i>Ptychogastria polaris</i>		x		x	
<i>Ptychogena lactea</i>	x				x
<i>Rathkea octopunctata</i>			x		x
<i>Rhacostoma atlanticum</i>	x				
<i>Sarsia princeps</i>			x		x
<i>Sarsia tubulosa</i>	x		x	x	x
<i>Staurophora mertensi</i>	x		x		x
<i>Tiaropsis multicirrata</i>	x	x	x		x
<i>Tima formosa</i>					x

A Bay of Fundy (including Passamaquoddy Bay)

B Atlantic coast of Nova Scotia

C Atlantic coast of Newfoundland Island (including Grand Banks)

D Atlantic coast of Labrador

E Gulf of St. Lawrence (including Cabot Strait and Strait of Belle Isle)

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Glossary of Scientific Terms

This glossary contains scientific terms used in the descriptions of orders (Siphonophora excluded), suborders (Siphonophora only), families, genera, and species, and keys to orders and genera.

Abaxial ocellus

Ocellus located on exumbrella surface of marginal tentacular bulb (Figure 5).

Aboral

Of or pertaining to a region away from or opposite to mouth.

Adaxial ocellus

Ocellus on subumbrella surface of marginal tentacular bulb (Figure 5).

Adradial

Pertaining to radial planes of medusae (Figure 6).

Ampulla

Small saclike swelling, e.g., terminal swelling of siphonophore tentillum.

Apical canal

Blind-ending canal arising from top of stomach towards apex of umbrella, e.g., in *Sarsia princeps* (p.30; Plate 1a).

Apical chamber

Small chamber-like expansion on top of stomach, e.g., in *Sarsia tubulosa* (p.30; Plate 1b).

Apical projection

Round or pointed projection on top of umbrella due to thickening of jelly in some medusae, e.g., in *Catablema vesicarium* (p.33; Plate 4a) and *Leuckartiara nobilis* (p.33; Plate 5a).

Asexual budding

New medusae budding off from marginal tentacular bulbs, radial canals, manubrium and other structures; common in Anthomedusae, e.g., in *Hybocodon prolifer* (p.31; Plate 1d).

Bract

Thick gelatinous, leaf-like or prismatic polypoid individual in Siphonophora; for protection and buoyancy of whole animal (Figure 7C).

Budding zone

A region in a siphonophore colony from which arise new medusoid and polypoid individuals (Figure 7).

Central disc

Lens-shaped jelly part of umbrella above coronal groove in some Scyphozoa, e.g., *Periphylla periphylla* (p.79; Plate 13a).

Centrifugal canal

Canal arising from ring canal and growing downwards towards umbrella margin, e.g., in *Phacellophora camtschatica* (p.80; Plate 14d).

Centripetal canal

Canal arising from ring canal and growing upwards towards but not reaching stomach, e.g., in *Eumedusa birulai* (p.34; Plate 5d).

Cordylus (pl. cordyli)

Club-like marginal structure, probably of sensory function, in Leptomedusae, e.g., *Laodicea undulata* (p.36; Plate 6c).

Cormidium (pl. cormidia)

Non-separating stem-group consisting of polypoid and medusoid individuals in Cystonectae and Physonectae, Siphonophora.

Coronal groove

Circumferential furrow on exumbrella in Coronatae, separating central disc from marginal zone of umbrella, e.g., in *Periphylla periphylla* (p.79; Plate 13a).

Crenulate

Scalloped or notched.

Denticulate

Having small toothlike projections.

Dichotomous

Dividing into two similar or equal branches.

Dioecious

With the two sexes on different bodies.

Diverticulum (pl. diverticula)

Blind, side branch.

Ectoderm or epidermis

Outermost layer of cells in body wall (Figure 2).

Endoderm or gastrodermis

Innermost layer of cells in body wall (Figure 2).

Eudoxid

Free-swimming cormidium after fragmentation of stem in calycophore Siphonophora, usually consisting of one gastrozoid with tentacle, gonophores, and a bract covering all other individuals.

Exumbrella

Outer convex surface of umbrella (Figure 5).

Float or pneumatophore

An inverted saclike structure in Siphonophora, with an outer wall, pneumatocodon, and an inner wall, pneumatosaccus or air sac (Figures 7A, 7B).

Gastric pouch

Small chamber in gastrovascular sinus partitioned by radial septa in Scyphozoa (Figure 8).

Gastrovascular canal

Canal arising from marginal end of gastrovascular sinus, e.g., in *Aurelia aurita* (p.80; Plate 14b).

Gastrovascular sinus

Marginal region of stomach in Scyphozoa.

Gastrozoid

Polypoid individual with a mouth and a long contractile tentacle arising from the base in Siphonophora, serving for feeding.

Gonads

Part of medusa where sex cells are produced (Figure 5).

Gonodendron (pl. gonodendra)

Complex of palpons, gonophores and sometimes asexual nectophores in Siphonophora.

Gonophore

Small sexual medusoid without tentacles in Siphonophora.

Hydroecium (pl. hydroecia)

Cavity on ventral side of nectophore to house retracted stem with its associated structures in Calyptophorae, Siphonophora (Figure 7C).

Interradial

Pertaining to radial planes of medusae (Figure 6).

Interradial gastric septum

Crescent-shaped area of fusion separating gastrovascular sinus from central stomach in Coronatae (Figure 8).

Lappet

Marginal umbrella lobe in Scyphozoa.

Lateral horn

Side branch near terminal end of tentillum in Siphonophora.

Manubrium

Portion of medusa hanging down from umbrella in subumbrella cavity like the clapper of a bell. It contains a stomach and in some cases a peduncle (Figure 5).

Marginal cirrus (pl. cirri)

Small tentacle-like structure without basal bulb located between marginal tentacles on umbrella margin in Hydrozoa (Figure 5).

Marginal sensory club

A club-like sensory organ with a central core of endodermal cells originating from ring canal and an outer layer of ectodermal cells in Hydrozoa (Trachymedusae and Narcomedusae). When hanging down from umbrella margin, known as free marginal sensory club (Figure 5); when entirely enclosed by ectoderm within umbrella, as closed marginal sensory club.

Marginal tentacle

Marginal structure of umbrella (Figure 5) mainly for capturing prey. It is formed by an outer layer of ectodermal cells and an inner layer or core of endodermal cells. When the endodermal cells grow as a continuation of the ring canal, the tentacle is known as hollow; when they form a core of cylindrical cells placed end to end, the tentacle is known as solid.

Marginal tentacular bulb

Dilated portion at base of marginal tentacle next to umbrella margin (Figure 5).

Marginal vesicle

Sensory organ formed by ectodermal cells from velum, located on lower surface of velum near umbrella margin (Figure 5). When the vesicle remains open to the velum, it is known as open; when it is entirely sealed off from the velum, it is known as closed.

Marginal wart

Small wart-like swelling on umbrella margin, e.g., in *Tima formosa* (p.39; Plate 8e).

Medusoid individual

Medusoid form in a siphonophore colony, including gonophores and nectophores.

Mouth

Opening of stomach to exterior (Figure 5).

Mouth plate

One of two anterior distal elongated plates of nectophore hydroecium in Calyptophorae, Siphonophora.

Nectophore

Asexual medusoid individual with a bell, velum, four radial canals and a ring canal but without mouth, manubrium, tentacles or marginal sensory organs in Siphonophora; serving for swimming (Figure 7C).

Nectosac

Subumbrella cavity of nectophore (Figure 7C).

Nectosome

Region of stem in siphonophores from which nectophores are budded (Figure 7B).

Nematocyst

Intracellular structure formed with a surrounding capsule containing a fluid and a coiled thread. Upon stimulation, the thread can be turned inside out, and may inject poisonous fluid into prey.

Non-tentacular marginal bulb

Bulb on umbrella margin never producing marginal tentacle.

Ocellus (pl. ocelli)

Sensory organ for light reception, usually located on marginal tentacular bulb (Figure 5).

Oral arm

Long frilled lobe drawn out from angle of four-cornered mouth in Scyphozoa or elongation of the mouth margin in Hydrozoa.

Oral lip

Margin of mouth (Figure 5). It may be simple and circular as in *Sarsia tubulosa* (p.30; Plate 1b), simple and perradially prolonged as in *Phialidium folleatum* (p.38; Plate 8c) or elongate and folded as in *Leuckartiara nobilis* (p.33; Plate 5a).

Oral tentacle

Simple or branched tentacle arising from manubrium surface above and near mouth, e.g., in *Bougainvillia principis* (Plate 3d).

Ostium (pl. ostia)

Velar end of nectophore in Siphonophora (Figure 7C).

Palpon

Reduced mouthless gastrozoid with a single tentacle in Siphonophora.

Pedallium (pl. pedalia)

Radial thickening of jelly between coronal groove and base of lappet on marginal zone of exumbrella in Coronatae, e.g., *Periphylla periphylla* (p.79; Plate 13a). Two adjacent pedalia are separated from each other by a deep radial groove on exumbrella.

Peduncle

Cone-shaped thickening of jelly projecting downwards from top of subumbrella cavity (Figure 5). Its lower end is attached to upper border of the stomach.

Peripheral canal system

Canal system running along umbrella margin and both sides of each peronium to form a number of loops in Narcomedusae; sometimes synonymous with ring canal.

Peronium (pl. peronia)

Strand of ectodermal cells running vertically between two marginal lobes on exumbrella in Narcomedusae, e.g., *Aeginopsis laurentii* (p.41; Plate 10d).

Perradial

Referring to radial planes of medusae (Figure 6).

Polygastric

Pertaining to a growth phase of Calycophorae, Siphonophora. In this phase, the stem of an animal carries a succession of gastrozooids and tentacles, each gastrozoid accompanied by a single bract and medusoid gonophores.

Polypoid individual

Polypoid form in a siphonophore colony, including gastrozoid, palpon, gonozoid, and bract.

Radial canal

Canal running from base of stomach to ring canal near umbrella margin (Figure 5).

Radial septum (pl. septa)

Radial partition in marginal region of stomach or gastrovascular sinus in Scyphozoa (Figure 8).

Reticulate

Net-like.

Rhopalium (pl. rhopalía)

Club-like sensory organ projecting from umbrella margin at cleft between two adjacent lappets in Scyphozoa, e.g., *Periphylla periphylla* (p. 79; Plate 13a).

Ring canal

Circular canal running round umbrella margin (Figure 5).

Siphosome

Region of stem in siphonophores from which gastrozoid, palpons, bracts, and gonophores are budded (Figure 7B).

Somatocyst

Blind tube-like structure in siphonophore nectophore (Figure 7C).

Statocyst

Sensory organ possibly of orientation function, e.g., marginal vesicle and marginal sensory club.

Stem

Budding zone in siphonophore colony from which arise the polypoid and medusoid individuals (Figure 7C).

Subgenital pit

Shallow depression on subumbrella surface interradially and beneath gonads in Semaestomeae.

Subumbrella

Inner concave surface of medusa umbrella (Figure 5).

Subumbrella cavity

Cavity enclosed by subumbrella (Figure 5).

Tentillum (pl. tentilla)

Lateral contractile branch of tentacle in siphonophore gastrozoid.

Umbrella

Gelatinous swimming bell of medusa.

Velum

Horizontal shelf around opening of subumbrella cavity in Hydrozoa (Figure 5).

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